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Heavy tank engines for suburban service are being introduced by the Illinois Central R. R. to facilitate the prompt handling of the suburban trains. They have six coupled driving wheels, a leading two-wheel or pony truck, and a trailing four-wheel truck under the tank. The engines were built by the Rogers Locomotive & Machine Works, Paterson, N. J., and the general particulars and dimensions are as follows:

Driving wheels (6), diameter	4 ft. 8½ ins.
Wheel base, driving	13 " 0 "
Wheel base, total	33 " 5 "
Weight, in working order, on drivers	92,000 lbs.
" on leading truck	18,000 "
" on trailing truck	50,000 "
" total	160,000 "
Cylinders	18 × 22 ins.
Ports, steam	1⅜ × 18 "
Ports, exhaust	3 × 18 "
Slide valves, lap, outside	⅞ "
Boiler, wagon top, radial stay; diameter	4 ft. 8 "
Working steam pressure	180 lbs.
Firebox; radial crown stays; 8 ft. 6 ins. × 2 ft.	8½ ins.
Tubes; number, 209; outs, diam.	2 ins.
" length	10 ft. 10 ins.
Grate area	23½ sq. ft.
Heating surface; tubes	1,185.5 sq. ft.
" " firebox	141.7 " "
" " total	1,327.2 " "

Another rich deposit of Bessemer-iron ore has been found in St. Louis Co., Minn., on a 40-acre tract owned by W. R. Burt, of Saginaw, Mich. It is estimated that 10,000,000 tons of ore are in sight, with only 15 ins. of surface soil. It is soft enough to be dug with steam shovels, and the mine has been leased at 30 cts. per ton royalty.

TheMozier block system, with three-position semaphores, which has been in use for some time on the Erie line, between Salamanca, N. Y., and Marion, O., is being applied on the Chicago & Erie R. R., and it is expected that by April 1 the Erie lines will be operated under the block system for the entire distance from New York to Chicago. The benefits of the system are stated to be already apparent in the freedom from collisions, the passenger trains especially being given absolute protection. There will be 62 block stations on the Chicago & Erie. This work, with the completion of new bridges and other improvements to the roadbed, is being crowded to completion preparatory to the handling of next summer's heavy passenger traffic.

The cable railways of Philadelphia, Pa., are to be rebuilt. According to a recent paragraph in the "Street Railway Review," the Philadelphia Traction Co. has decided to thoroughly overhaul and reconstruct the entire cable system. When the lines were built the cost of cable work was nearly double what it is to-day, and the experience which has come from 15 years of cable operation did not then exist. The management took chances and expected to make a much cheaper construction answer the purpose. The result proved anything but satisfactory. Frequent stoppages, delays and breakdowns followed one another in such rapid succession as to make the cable system unpopular in Philadelphia. Reconstruction has been the constant history of the road from its opening day, and while of late years many evils have been remedied, the system was far inferior to the cable systems of Chicago and other cities.

The Midland Railway Co., of England, is said to be stripping five full trains of electric light apparatus, and applying the Pintsch compressed oil gas light equipment in its stead. The Midland Ry. is one of the most progressive of English roads, and has conducted extensive tests of electric lighting for its trains on a practical scale. As stated in our articles on car lighting in 1891 (since published in book form), the Midland Ry. had six trains equipped with the electric light, the dynamos being driven from one of the car axles, and storage batteries being placed on each car to supply the current when the train is not running. The company had also four other trains fitted with different types of motor connected direct to the dynamo.

The New York and New Jersey Bridge bill was passed by the House in Washington, on Feb. 20, by a two-third vote. The entire New York delegation voted for it on the ground that the recent amendments to the bill have removed its objectionable features.

A long mileage of steel tires is reported by the Midvale Steel Co., of Nicetown, Philadelphia, Pa. On April 20, 1882, engine 35, tired with Midvale tires, went into service on the Cumberland Valley R. R., and has made the following mileage record. The tires on this engine have been turned but once, and are still in use:

	Miles.
1882	33,954
1883	57,594
1884	57,058
1885	57,930
1886	54,789
1887	55,654
1888 (to April)	11,990
To first turning	328,969 miles
From April, 1888, to Dec. 31, 1892	173,591 "
Total	502,560 miles

The most serious railway accident of the week was the derailment of a passenger train on the Pittsburg, Fort Wayne & Chicago R. R. near Columbia City, Ind., Feb. 22. Two of the cars went down the bank. Only one person was killed, but 28 were injured.

A wall of the burned York building at Halsted and 19th Sts., Chicago, which had been left standing in an insecure condition, was blown over Feb. 28 and fell on the two-story buildings adjoining, crushing them in, and the wreck caught fire. The wall was five stories high. There were 7 persons killed and 3 injured, 1 fatally. According to report the building commissioner had issued a permit allowing the contractors who were putting up the new building for Mr. York to use the north and front walls of the old building in erecting the new one. Permission to use these walls was granted in the face of adverse reports from inspectors of the district, and these were the walls which fell. The building commissioner is said to charge that the owners and contractors are to blame. When asked why the walls were not ordered to be destroyed immediately after the fire last January, he said that he had given orders to tear down all dangerous walls, but it was the business of the contractors to look after them. He claimed that the north and front walls were perfectly sound, and would be standing now were it not for the gale. He had no power to tear down dangerous walls.

The coast-line battle-ship "Indiana," now launched, was contracted for in November, 1890, by William Cramp & Sons, for $2,990,000. The first keel-plate was laid May 7, 1891. As built the "Indiana" has the following dimensions: Length, 348 ft.; extreme breadth, 69¼ ft.; mean draft, 24 ft.; displacement, 10,200 tons; horse power, 9,000; speed per hour, 15 knots. The armament will consist of four 13-in. and eight 8-in. breech-loading rifles; four 6-in. rapid-fire guns; twenty 6 pdrs.; four 1 pdr. rapid-fire and four Gatling guns. The vessel has a double bottom, divided into many water-tight compartments; and a middle-line bulkhead, well stiffened horizontally and vertically between the two engine rooms and the fire-room, adds great strength to the ramming power of the ship. She has no sails and only one military mast. The "Indiana" will require 2,904 tons of nickel-steel armor. The 613 tons on the water line belt will be 18 ins. thick, extending 3 ft. above and 4½ ft. below the water line. The 13-in. batteries at both ends will have 17-in. armor, extending 3½ ft. above the main deck and giving an armored free-board of 15 ft. 2 ins. The 8-in. guns will be protected by 10-in. steel barbettes. Heavy protection domed decks extend forward and aft of the armor belt and end 4½ ft. below the water line. The engines are of the twin-screw, vertical, triple-expansion direct-acting, inverted cylinder type.

The Committee on Compound Locomotives, of the Master Mechanics' Association has sent out a circular letter asking for the results of comparative tests of simple and compound locomotives. The questions asked indicate a determination by the Committee to get at the bottom of the conflicting claims concerning expense of repairs on compounds.

The latest new steel making process is reported from St. Louis. It is stated that a company with $1,000,000 capital has been organized to exploit a process invented by Benjamin Brazelle, which uses gas fuel, and is claimed to be able to compete in cost with the Bessemer process.

Under two bills now before the New York Legislature the limit of expenditure to $3,000,000 per year for the New York Dock Department is to be removed, and this department is allowed to spend all it can get. The second bill amplifies and centralizes the powers of the Dock Department. It is said that under these bills expenditures to the amount of $17,000,000 are contemplated; in the purchase of dock property and the construction of new streets alongside the docks for the use of shippers.

The chemical and microscopical analysis of the ten-thousandth sample of water was recently completed for the Massachusetts State Board of Health, at the Massachusetts Institute of Technology. This work was begun in June, 1887, under authority of an act to protect the purity of inland waters, since which a systematic study has been made of the public water supplies of the state. The detailed results of these studies are published in the reports of the Massachusetts State Board of Health, whose valuable work in this, as in other directions, is recognized both in this country and in Europe, and has often been commended in these columns. The chemical work connected with the examinations is under the direction of Dr. Thomas M. Drown, Professor of Analytical Chemistry, and Mrs. R. H. Richards, Instructor in Sanitary Chemistry at the Institute of Technology. The biological examinations are under the charge of Dr. William T. Sedgwick, Professor of Biology, who is assisted by Mr. Cary N. Calkins. Mr. F. P. Stearns, M. Am. Soc. C. E., is the Chief Engineer of the Board, and Dr. S. W. Abbott, is Secretary. Mr. X. H. Goodnough is Assistant Engineer.

A revised building ordinance is now before the City Council of Chicago, Ill., fixing the maximum height of buildings at 100 ft. above the sidewalk level. It favors piles for foundations, but does not forbid the use of steel or iron rails. All buildings devoted to the sale, storage or manufacture of merchandise, and all stables which are 100 ft. or more high, must be entirely of fireproof construction. Buildings of less than 100 ft. and more than 60 ft. high, must be entirely of slow-burning or mill construction; buildings of less than 60 ft. in height may be of ordinary construction. In Class 2, buildings used as residences for three or more families, hotels, boarding or lodging houses, etc., occupied by 25 or more persons, and all office buildings which are 90 ft. or more high, must be entirely of fireproof construction. If less than 90 ft. and more than 60 ft., their construction must be slow-burning or mill construction. If they are less than 60 ft. in height their construction may be of the ordinary sort. Class 3, all buildings used as residences for one or two families, or for less than 25 persons, may be built of ordinary construction, except if they are 60 ft. or more high, they must conform to the limitations fixed for buildings of Class 2. In Class 4, all buildings used as assembly halls for large gatherings, whether for purposes of worship, instruction, or entertainment, must be safely constructed under rigid rules. Height of buildings of non-fireproof construction is estimated from the sidewalk level to the highest point of the roof. It is probable the ordinance will be further revised before finally becoming a law. Such changes as are made will probably be in minor details or verbiage, as the main points have already been fully covered. The comment is made that this ordinance is too comprehensive and unwieldy.

An electric pumping plant with a capacity of 2,000,000 gallons per 24 hours, is to be started at the San Antonio, Tex., water-works, by the Gould's Mfg. Co., of Seneca Falls, N. Y. The plant will for the present consist of three 10 × 12 "triplex," or three-cylinder pumps, each driven by a 30-HP. C. & C. electric motor. The water is taken from four 8-in. artesian wells, 2,500 ft. in depth, and is delivered into a 22-in. main leading to a reservoir, three miles distant, and 165 ft. above the pumping station. The electric current is taken from the power station of the city electric lighting plant at present; but ultimately the pumping plant will be increased to 10,000,000 gallons daily capacity, and current will be generated at a point three miles distant, where water power is available. The Gould triplex pump was illustrated in our issue of Nov. 14, 1891.

THE DISCHARGE OF THE NIAGARA RIVER.

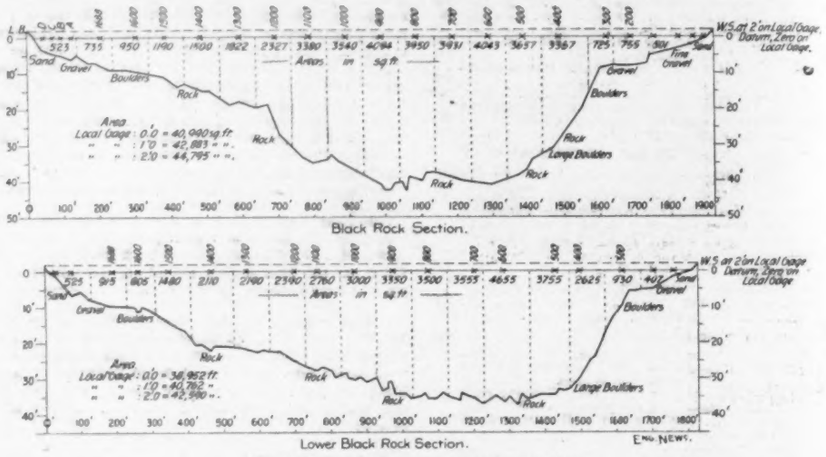
In 1891, the American Society of Civil Engineers made a request of the Chief of Engineers, U. S. A., that a new measurement be made of the discharge of the Niagara River. Complying with this request, the Chief of Engineers directed Major A. Stickney, then in charge of the United States Engineer Office, at Buffalo, N. Y., to have this done, and Mr. J. C. Quintus was detailed for the work, and made a series of measurements in December, 1891. These appeared somewhat at variance with previous measurements, and a new set was taken in May, 1892, confirming those of December. For the privilege of publishing this latest measurement of flow we are indebted to Major E. H. Ruffner, Engineer Corps, U. S. A., who succeeded Major Stickney some time last year. The following report is dated Nov. 8, 1892, and is given in full, only omitting some unimportant detail of movements, and supplying a description of methods taken from the previous report of Mr. Quintus.

For the better understanding of the report of Mr. Quintus, we make such extracts from his first report as seem necessary, as follows: The point selected for measurement was about 1,000 ft. below the International Bridge, in front of Black Rock, and near the foot of Squaw Island. At this point the river is straight and has no eddies. The Niagara River, as it leaves Lake Erie, at Buffalo, N. Y., is contracted into a nearly straight channel about 2,000 ft. wide and two miles long. This part of the river has a rapid fall and high velocity, ranging from about seven miles per hour at the upper end to about five miles at the lower end. At the foot of Squaw Island the river spreads out and is divided into two channels by Strawberry Island, and subsequently by Grand Island. Thence to the Rapids above the falls the river is wide, shallow and obstructed by small islands.

Evidently the straight reach, at the head of the river, was best adapted for a determination of the discharge; but there the current was swift, the bottom irregular and obstructed by large masses of rock, and shoal water extended out a considerable distance from shore. The lower half of the reach, about one mile long, is bounded on the east by the straight shore of Squaw Island, and on the west by the straight shore of Canada, with a width of 1,900 ft. The current is swift, but free from shore eddies; and the bottom, though obstructed by rock and bowlders, is comparatively regular. About 2,000 ft. above the foot of the island the International Bridge spans the stream between Squaw Island and Canada, with eight piers in the river at intervals of 150 and 200 ft. Owing to dangerous rocks, a strong current and several hundred feet of shoal shore, a good section could not be obtained above the bridge; and a very strong steam launch would have been required. To go below the bridge would seem to invite unreliable results from the disturbance due to the piers. But an examination of these elements led to the opinion that at a point about 1,000 ft. below the bridge the disturbance produced by the bridge piers is nearly, if not quite, dissipated. The series of current observations taken from this section also shows a remarkably constant relationship between the velocities at 100 ft. apart.

In taking the cross-section, the width, which varies slightly with different stages of the river, was determined for gage readings, one foot apart; and for intermediate gage readings the width was determined by interpolating values derived from the determined slope of the river banks. The width of the river was determined by transit angles from a base line 956 ft. long at right angles to the section, and also by measuring the distance between perpendiculars to the section on the International Bridge. The area of the section was determined by sounding the section twice, in opposite directions, at 25 ft. intervals, and locating soundings by transit angles from the base line. Soundings were also taken daily at the meter stations. The lead used weighed 15 lbs., and the sounding line was tested daily after use and all soundings corrected. A local water gage was established on the draw-pier of the bridge, and two gage-boards were set up on each side of this pier. The zeros of these gages were on the same level; so that if the water was choppy at one it would be quiet at the other. The local gage was read at the beginning and close of velocity observations, and the United States gage, at Buffalo, was read at 7 a. m. and 1 and 7 p. m. The zero of this latter gage is at mean level of Lake Erie, or 572.06 ft. above mean tide at New York. During the velocity observations Lake Erie was below its mean level of about 1.5 ft., when not affected by strong winds.

The current velocities were obtained after the method used by the Mississippi River Commission. The section was marked by two range targets, about 500 ft. apart, set on Squaw Island. For fixing the position of velocity stations on the section, points 100 ft. apart were located on the International Bridge. Two range poles, one on each side of the bridge, hung below the lower chords, and were set as nearly vertical as possible and 25 ft. apart, the width of the bridge. Prominent objects along the bank, in the range of the poles, were selected as back-ranges; these were principally chimneys, and a diagram recording these back ranges was made and hung in the pilot house of the tug for the guidance of the pilot. All velocity observations were taken by a Price No. 36 electric current meter, made by Gurley, of Troy, N. Y., operated from the tug. In measuring the velocities the tug was held stationary on the ranges for each velocity section by means of the tug's propeller and rudder. Anchoring the tug was impossible, owing to the rock bottom. The meter was suspended from a boom projecting about 8 ft. over the stern quarter, and making an angle of about 45° down stream with the axis of the tug, by a wire cable passing through the sheave in the outboard end of the boom. The inboard end of the cable was wound on a reel, and to the outboard end were secured the foot-weight and rod, furnished with the instrument, and the meter attached thereon. Two insulated electric wires were wound



DISCHARGE SECTIONS, NIAGARA RIVER.

TABLE No. II.—Discharge of Niagara River, N. Y.

Date.	Local Gage. At begin., obs., ft.	Local Gage. At close obs., ft.	Local Gage. Mean, ft.	Buffalo Gage. At begin., obs., ft.	Buffalo Gage. At hour intervals during obs., ft.	Buffalo Gage. At close obs., ft.	Buffalo Gage. Mean, ft.	Area of Section. Width of section, ft.	Area of Section. Mean depth, ft.	Area of Section. Datum at gage = 0, sq. ft.	Area of Section. Water, sq. ft.	Mean velocity, ft. per sec.	Discharge cu. ft. per sec.	Wind at Buffalo.	Remarks.
1891, Dec. 24	0.060	— 0.100	— 0.050	— 3.2	Not taken	— 2.7	— 2.95	1,883.4	21.7	40,935	40,841	4.031	164,648	N. E. 11 –12	B. R. section.
" 14	0.800	0.500	0.650	— 1.8	" "	— 1.9	— 1.85	1,896.5	22.2	"	42,162	4.550	191,822	S. W. 13, N. E. 3	" "
" 21	0.800	0.670	0.735	— 1.7	" "	— 1.8	— 1.75	1,898.3	22.3	"	42,315	4.573	193,522	S. E. 5, E. 11	" "
" 19	0.830	0.750	0.790	— 1.7	" "	— 1.9	— 1.80	1,899.5	22.3	"	42,449	4.623	196,252	S. 4, W. 3	" "
" 11	0.830	0.750	0.790	— 1.5	" "	— 1.6	— 1.55	1,899.5	22.3	"	42,449	4.557	193,448	W. 8—11	" "
" 20	0.750	0.920	0.835	— 1.8	" "	— 1.7	— 1.75	1,900.1	22.4	"	42,506	4.739	201,433	S. 9—10	" "
" 28	1.000	0.900	0.950	— 1.6	" "	— 1.6	— 1.60	1,902.3	22.5	"	42,734	4.711	201,320	S. E. 5—6	" "
" 25	0.980	0.960	0.960	— 1.6	" "	— 1.7	— 1.65	1,902.7	22.5	"	42,252	4.716	201,612	S. W. 8—5	" " 8 stations across stream.
" 22	1.170	1.080	1.125	— 1.5	" "	— 1.4	— 1.45	1,905.4	22.6	"	43,077	4.842	208,597	S. 19.2, S. W. 2.5	" "
'92, April 30	1.010	1.250	1.130	— 1.7	— 1.4, — 1.4, — 1.5	— 1.2	— 1.40	1,905 4	22.6	40,990	43,132	4.817	207,775	N. 6, S. W. 10	" "
" 29	1.300	1.330	1.315	— 1.2	— 1.1, — 1.1	— 1.1	— 1.13	1,908.9	22.7	"	43,492	4.875	212,024	S. W. 10—17	" "
'91, Dec. 10	1.330	1.330	1.330	— 0.4	Not taken	— 0.6	— 0.50	1,909.1	22.7	40,935	43,458	5 024	218,353	S. W. 26—21	" "
'92, May 10	1.330	1.330	1.330	— 0.9	— 0 9, — 1.0, — 0.8	— 1.1	— 0 93	1,909 1	22.8	40,990	43,513	5.059	22 ,121	N. E. 12, E. 14	" "
'91, Dec. 12	1.420	1.380	1.400	— 1.4	Not taken	— 1.0	— 1.20	1,910.7	22.8	40,935	43,592	5 073	221,158	S. W. 24, W. 23.5	" "
'92, May 19	1.500	1.625	1.562	— 0.7	— 1.1, — 0.8	— 0.3	— 0.80	1,833.7	22.8	38,952	41.781	5.102	213.180	S. E. 15	L. B. R. section.
" 18	1.500	1.667	1.584	— 0.9	— 3.8, — 0.8, — 0.7	— 0 8	— 0.79	1,831.0	22.8	"	41,826	5.201	217.5 0	E. 7—14	" "
" 14	1.583	1.583	1.583	— 0.7	— 0.8, — 0.9, — 0.9	— 0.8	— 0.84	1,913.0	22.9	40,990	43,991	4.963	218.330	S. 4—6	B.R. "
" 13	1.737	1.625	1.681	— 0.6	— 0 7, — 0.7, — 0.5	— 0.7	— 0.64	1,914.9	23.0	"	44,132	5.060	223,561	S. 7, S. W. 11—3	" "
" 11	1.708	1.667	1.688	+ 0.8	+ 0.4, + 0.5	+ 0.9	+ 0.58	1,915.0	23.0	"	44.199	5.112	225,8'6	S. W. 15—14	" "
" 7	1.800	1.700	1.750	— 0.8	— 0.9	— 0.8	— 0.85	1,916.9	23.1	"	44.316	4.941	218,968	N. W. 2—11	" "
" 12	1.833	1.833	1.833	— 0.5	— 0.6	— 0.6	— 0.78	1,918.4	23.2	"	44,489	5.052	224,715	S. W. 7—9	" "
" 16	1.750	1.917	1.833	— 0.6	— 0.6, — 0.5, — 0.5	— 0.2	— 0.50	1,837.0	23.0	38,952	42,282	5.206	220,121	W. 18—12	L. B. R. section.
'91, Dec. 16	1.750	1.920	1.835	— 0.4	Not taken	— 0.2	— 0.30	1,916.4	23.2	40,935	44,419	5.054	224,485	W. 15.5—18	B. R. "
'92, May 20	2.250	1.667	1.959	+ 0.5	+ 0.4, — 0.2, — 0.9	— 0 9	— 0 38	1,838.7	23.1	38,952	42.511	5.278	224,360	S. W. 24—14	L. B. R. "
" 25	2 000	2.000	2.000	— 0.1	— 0 2, — 0.3, — 0 3	— 0.2	— 0.24	1,839 0	23.2	"	42.599	5.306	225,989	S. W. 12—11	" "
" 23	1 917	2.083	2 000	— 0.2	— 0 2, — 0.1	— 0.2	— 0.17	1,921.5	23.3	40,990	44,795	5.341	239,677	N. E. 4, N. W. 5	B. R. "
" 27	2,125	2.083	2.104	0.0	— 0 3, — 0.3, — 0.3	— 0.3	— 0.27	1,840.5	23.2	38,952	42.776	5.290	226,264	W. 13, N. W. 18	L. B. R. "
" 26	2.052	2.250	2.146	— 0.3	— 0.3, — 0.1, + 0.1	0.0	C.09	1,810.8	23 3	"	42.859	5.424	232,448	S. W. 12—15	" "
" 28	2.268	2.167	2.188	0.0	— 0.1, 0.0, 0.0	— 0.1	— 0.04	1,842.0	23 3	"	42,937	5.392	231,513	S. W. 4, W. 11	" "
" 24	2.208	2.375	2.292	— 0.1	0.0, + 0.2, + 0.3	+ 0.4	+ 0.15	1,843.5	22.3	"	43,122	5.491	236,762	S. W. 13—14	" "

around the entire length of the cable, and formed the connection between the electric dial register on the tug. A guy line was secured to the foot-weight rod, passed through a pulley at the outer end of a boom projecting about 8 ft. beyond the bow of the tug, and thence inboard to a timber-head on the tug. This gave to the lead of the guy line a horizontal component of 40 ft., and by means of this line the meter cable could be kept vertical to all depths down to 40 ft.

Each revolution of the meter wheel was reported on the electric dial register on the tug, and the time was recorded by a watch with a large second hand traversing the whole face. The velocity of each station was determined by observing the number of revolutions of the meter at six-tenths of the depth for five minutes. After this, velocities in the vertical were observed, as follows: One foot below the surface, at 5 ft. intervals, and about one foot from the bottom. With this data from the report of Mr. Quintus, of Feb. 1, 1892, his last report, which now follows, will be more readily understood:

This series of measurements was supplemental to the series of December, 1891, and this report is therefore made supplemental to the report on the first series, submitted in February, 1892. In the table of discharges, and on the plat accompanying this report, the results of both series of observations are, however, incorporated.

The discharge observations were taken over the Black Rock section, as described in the first report, and shown in the sketch on its accompanying plat, and over a section 600 ft. below it, designated as the Lower Black Rock section. The Black Rock section was identical with the original section, all range targets, monuments, gages, etc., being found intact. The Lower Black Rock section was established in order to check the measurements on the Black Rock section, and also to secure a section with a uniform river bottom. The cross-sections were sounded and measured by the methods employed for the first series. The soundings over the Black Rock section agreed very closely with those of the first series, and no change was made in the area of the section, excepting a change of 55 sq. ft. in the partial area for station 800. The two sections are shown on the accompanying plat; the Black Rock section being revised as above noted.

The local water gage, on the draw pier of the International Bridge, used during the first series of measurements, was found intact, and used during this series. The local gage height was observed at the beginning and close of velocity observations. The U. S. gage, at Buffalo, showing the level of Lake Erie, was observed daily, every hour from 8 a. m. to 4 p. m. During this series of discharge measurements, the level of Lake Erie was gradually rising, from 1.5 ft. below mean lake level, very low stage, to about mean lake level. The observations for current velocities were made in the same manner as in the first series. The same current meter, Price No. 36, was used.

The measurement of discharges was begun on April 29, the plan of operation being to obtain a complete set of velocity observations, at six-tenths depth daily, at each of the 16 velocity stations distributed over the cross-section, from bank to bank, together with observations of velocities in verticals, at five feet intervals from surface to bottom, at each station, soundings at each station and observations for river slope.

For the computation and reduction of river discharges, the same processes and methods were employed as for the first series, and as described in the first report. On four different days 161 meter ratings were taken, and also 11 slope observations. The meter coefficients, for converting the revolutions of the meter wheel to velocity in feet per second, were determined from the rating observations by the formation and solution of normal equations by the method of least squares. The results are given in the following table.

Table No. 1 (meter coefficients).

Date, 1892.	No. observations.	Range of observed velocities, ft. per sec.	Meter coefficients. a.	b.	Remarks.
April 28..	20	2.5 — 7.3	4.239	+ 0.	Still water
" 29..	34	2.1 — 6.7	4.256	+ 0.061	Base line 150 ft.
May 4..	49	1.7 — 7.7	4.046	+ 0.207	"
" 17..	45	2.0 — 8.0	4.130	+ 0.067	Base line 300 ft.
Mean.			4.168	+ 0.084	

Note.—April 29, meter-wheel started by hand, ran 283 seconds before coming to rest. May 27, wheel ran 320 seconds before coming to rest. The meter was oiled daily before using.

The meter, Price No. 36, used during the entire series of observations, was not injured in any way; nor were any of its adjustments changed. The four ratings may, therefore, be regarded as having equal weight in determining the meter coefficients. The arithmetical mean has therefore been adopted in the discharge computations; the equation for converting revolutions of meter per second into velocity in feet per second being:

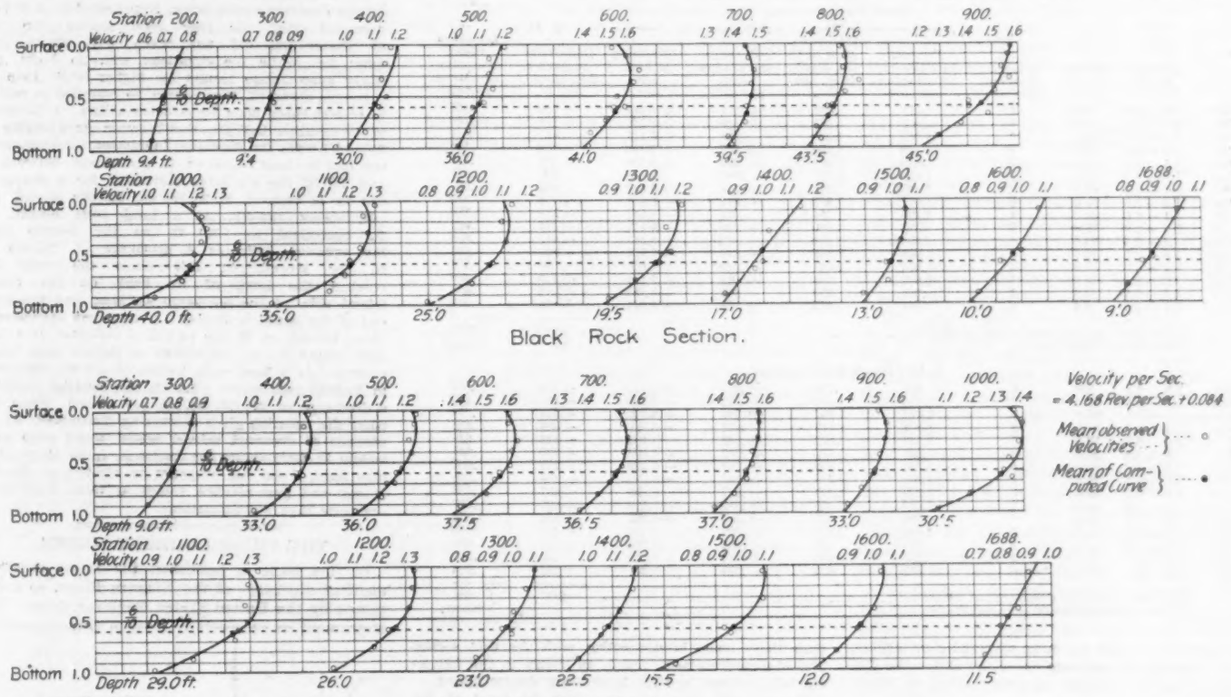
Velocity in feet per sec. = 4.168 revs. per sec. + 0.084.

The method employed in computing the discharges is fully explained in the report on the first series of observations. All of the discharge values are based upon the velocities observed at six-tenths depth, the investigation of the velocities observed in verticals, at each meter station, proving that the mean velocities are located at, or very nearly at that depth. For determining the velocities to be applied to the two end areas, the coefficients determined by special observation between the end meter stations and the shores during the first series of observations were used for the Black Rock Station. Coefficients derived from the similar special observations, made on May 17, were applied to the end areas on the Lower Black Rock section. All of the discharges having been computed by the prescribed form, the tabulation of results was compiled as given in the accompanying table of discharges.

In order to make the table as complete as possible the results obtained during the first series of observations are incorporated in the table, and the discharges arranged in the order of local gage heights. It will be noted on comparison with the table in the report of the first series, that slight differences occur in the values of discharges for the first series. The average difference in corresponding discharge values is about 1%; the maximum difference being about 2¾%, and only three values showing a difference of 2% or over. The reason for changing the discharge values, although the changes can have weight on general results, is this: In the computation of results as given in the first table, the mean of the several meter ratings was not used for computing velocities, as the meter was supposed to have undergone changes in rate between ratings. A system of adjusted values for the meter coefficients was therefore used, as described in the first report. The more extensive knowledge of the meter gained during its use on the second series of observations, and the close agreement between the means of the two series of ratings, leads to the opinion that the arithmetical mean of the three ratings of the first series would be a more consistent value to adopt. The discharge values of the first series have therefore been revised and adopted, as given in the table, being based upon the arithmetical mean of the three ratings of Dec. 9, 11 and 26, 1891. The small percentage difference goes to show that small discrepancies in the determination of meter coefficients have but little effect on final discharge values.

The wind velocities at Buffalo, N. Y., during the time of velocity observations, given in the table, are compiled from data furnished by the U. S. Weather Bureau. It is a question whether the local winds at the discharge sections had any effect on the river-currents. Such effects, if any, must have been very slight. The water surface was at no time more than "choppy," and never disturbed so as to appreciably affect the meter. The table of discharges may be regarded as the summary of the two series of discharge observations.

On the accompanying plat are shown the cross-section



Black Rock Section.

Lower Black Rock Section.

VERTICAL VELOCITY CURVES OF THE DISCHARGE OF THE NIAGARA RIVER.

Computed from Mean Observed Velocities Expressed in Revolutions of Meter per Second. Depth Regarded as Unity.

areas, mean velocities and discharges, as given in the table, platted to local gage. The "smooth curve" of discharge drawn on the plat is the computed curve based upon the discharge values as platted. The curve is derived from 30 equations, of the form $y = 8 + Tx + Ux^2$, etc., formed from the observed discharges. The computations were made by the method of least squares and normal equations, solved by the Gauss method of substitution. The equation of the curve of river discharges, as determined, is:

$$\text{Discharge} = 166{,}000 + 48{,}742x - 6{,}182x^2, \text{ etc.},$$

in which x = local gage-height in feet and tenths.

In order to determine the relation between the local gage and the Buffalo gage, denoting the level of Lake Erie, the mean gage heights covering the same space of time on both gages, during the time occupied in observing for discharge, were platted, as shown in the drawing. These mean gage heights are given in the discharge table. The curve shown in the computed "smooth curve" of gage relation, based upon the mean gage heights, as platted. The curve is derived from 30 depth; and the differences in partial and total discharges resulting from the differences in mean velocity values:

As shown, the mean location of the mean velocity across the stream is at 0.58 depth on the Black Rock section, and the results would indicate that the velocity values obtained at six-tenths depth would be a trifle smaller than the curve means. The discharge difference is consistent therewith; the discharge based upon the curve means being about 1% greater than that based upon mean six-tenths depth velocities. On the Lower Black Rock section the mean location of the mean velocity across the stream is at 0.60 depth, and the results would indicate that the velocity values should agree. The practically insignificant difference in discharges is consistent therewith. From the foregoing results it may be fairly inferred that the river discharges, based upon six-tenths depth velocities, are reasonably exact.

The slope observations made in connection with this series of discharge measurements were more extended, and made under much more favorable circumstances

TABLE III.—Value and Location, Curves of Mean Velocities.

Black Rock Section.

Velocity sta.	Range local gage.	Mean depth, feet.	No. sets observed. Velocities.	Mean Velocities. By comp'd curve. Revolutions per sec.	Mean Velocities. Observed at 6 ft. 10 ins. d'pth. Rev. per sec.	Difference in revolutions per sec.	Difference in feet per sec.	Difference in partial discharge, cu. ft.	Location mean velocity on curve. Depth.
*200	1.1 — 2.0	9.35	4	.693	.669	+ .024	+ 0.184	+ 166	.467
300	1.6 — 2.0	9.35	3	.806	.797	+ .009	+ 0.122	+ 101	.500
400	1.1 — 2.0	30.0	4	1.112	1.120	— .008	— 0.117	— 417	.537
500	1.6 — 2.0	36.0	3	1 115	1.088	+ .027	+ 0.196	+ 746	.561
600	1.1 — 2.0	41.0	4	1.539	1.533	+ .006	+ 0.109	+ 457	.648
700	1.6 — 2.0	39.5	3	1.450	1.450	.000	0.000	000	.673
800	1.1 — 2.0	43.5	4	1.490	1.462	+ .028	+ 0 201	+ 824	.699
900	1.6 — 2.0	45 0	3	1.457	1.411	+ .046	+ 0.276	+ 1,171	.596
1,000	1.1 — 2.0	40.0	4	1.170	1.184	— .014	— 0.142	— 524	.678
1,100	1.6 — 2.0	35.0	3	1.192	1.205	— .013	— 0.138	— 487	.624
1,200	1.1 — 2.0	25.0	4	1.046	1.046	— .020	— 0.167	— 414	.623
1,300	1.6 — 2.0	19.5	3	1.089	1.099	— .010	— 0.126	— 248	.605
1,400	1.1 — 2.0	17.0	4	1.001	1.001	.000	0.000	000	.500
1,500	1.6 — 2.0	13.0	3	1.001	.989	+ .012	+ 0.134	+ 179	.600
1,600	1.1 — 2.0	10.0	4	.967	.919	+ .048	+ 0.284	+ 312	.538
1,688	1.3 — 2.0	9.0	2	.911	.873	+ .038	+ 0.242	+ 214	.518
	Difference in total discharge of 223,000							+ 2,080	.5804 mean.
	Percentage difference							+ 0.9	

Lower Black Rock Section.

300	1.6 — 2.3	9.0	6	.804	.788	+ .016	+ 0.151	+ 168	.557
400	1.6 — 2.3	33.0	7	1.180	1.200	— .020	— 0.167	— 460	.639
500	1.6 — 2.3	36.0	7	1.178	1.167	+ .011	+ 0.130	+ 514	.594
600	1.6 — 2.3	37.5	8	1.565	1.577	— .012	— 0.134	— 656	.639
700	1.6 — 2.3	38.5	7	1.514	1.527	— .013	— 0.138	— 516	.641
800	1.6 — 2.3	37.0	8	1.527	1.525	+ .002	+ 0.092	+ 339	.615
900	1.6 — 2.3	33 0	6	1.518	1.529	— .011	— 0.130	— 479	.630
1,000	1.6 — 2.3	30.5	7	1.308	1.321	— .013	— 0.138	— 439	.639
1,100	1.6 — 2.3	29.0	6	1.226	1.253	— .027	— 0.196	— 557	.638
1,200	1.6 — 2.3	26.0	7	1.239	1.233	+ .006	+ 0.109	+ 280	.607
1,300	1.6 — 2.3	23.0	7	.995	.971	+ .024	+ 0.184	+ 437	.570
1,400	1.6 — 2.3	22.5	9	1.088	1.066	+ .022	+ 0 176	+ 410	.566
1,500	1.6 — 2.3	13.5	6	.970	.936	+ .034	+ 0.226	+ 376	.600
1,600	1.6 — 2.3	12.0	7	.963	.948	+ .015	+ 0.146	+ 139	.583
1,688	1.6 — 2.3	11.5	6	.833	.805	+ .028	+ 0.201	+ 221	.504
	Difference in total discharge of 236,000							— 232	.601 mean.
	Percentage difference — Insignificant.								

equations, formed from the mean observed gage heights, solved by the same methods as employed for the discharge curve. The equation of gage relation, as determined, is:

$$\text{Local gage height} = 2.087 + 0.624x - 0.046x^2, \text{ etc.},$$

in which x = Buffalo gage height in feet and tenths, + or — above or below zero. Zero of Buffalo gage = mean level of Lake Erie. From these two equations the level of Lake Erie. From these two equations the mean river discharge can be computed, the Buffalo gage height being known.

In connection with the discharge observations, velocities in the verticals from surface to bottom, at each of the velocity stations, were taken immediately after the observation of velocity at six-tenth depth, as described in the report of the first series. The object of these observations was to prove, if possible, the generally accepted theory that the six-tenths depth velocities are the mean velocities of the stream. The observations of velocities in verticals were taken as often as practicable. At the velocity stations on the Black Rock section, complete sets were obtained on four days at the even-numbered stations, and on three days at the odd-numbered stations; on the Lower Black Rock section, six to nine complete sets were obtained at all of the velocity stations. The mean of these observations for each station were platted, as shown on the accompanying plat, in terms of meter revolutions per second, to the depth regarded as unity. In each case the "smooth curve" of velocities in the vertical was computed from the mean observed velocities, as plotted; the computations being based upon from three to ten observation equations, according to depth; normal equations were formed by the method of least squares, and solved by the Gauss method of substitution. The mean velocity of each curve was then determined and plotted on its curve as shown.

The following table shows the values and locations on the curves of the mean velocities of the computed curves; the differences between these means and the corresponding mean observed velocities at six-tenths

than those made in connection with the first series. The observations were taken, as shown in the following table, along the right bank along Squaw Island.

Slope stakes were set; one near the head of the island, one at the International Bridge, and one on the lower discharge section. The elevations of the stakes were carefully determined by three lines of levels. The slope readings were taken simultaneously on the three stakes, and only at times when the water level could be closely measured on the stakes:

Table No. 4. Slope Observations.

Date. 1892.	Local gage, ft.	Which river bank.	Dist. above B. R. Sec., ft.	Dist. below B. R. Sec., ft.	Total distance, ft.	Diff. in elevation, ft.	Slope, per ft.
May 3.....	1.20	Right	3,273	600	3,873	0.457	.000118
" 4.....	1.65	"	"	"	"	0.599	.000155
" 5	0.96	"	"	"	"	0.516	.000133
" 6.....	1.33	"	"	"	"	0.475	.000123
" 7	1.58	"	"	"	"	0.558	.000144
" 9	1.33	"	"	"	"	0.474	.000123
" 10.....	1.31	"	"	"	"	0.535	.000138
" 12	1.93	"	"	"	"	0.558	.000144
" 18.....	1.67	"	"	"	"	0.557	.000144
" 20.....	1.50	"	1,610	"	1,610	0.213	.000132
" 23	2.04	"	"	"	"	0.220	.000137
						Mean.	.000136

This gives a slope of 0.718 ft. per mile. This result is well in accord with the slope implied by the hydraulic conditions.

The difference between the level of the Erie Canal and the river at the canal lock at Black Rock, almost exactly on the line of the Black Rock discharge section, was measured on May 9 and 20, and found to be 5 ft. The level of the canal at this point is practically the level of Lake Erie. The distance from the lock to the head of the river is about four miles. The average slope would therefore be about 1.25 ft. per mile; but the greater part of the fall of 5 ft. occurs in the second and third miles of river, from the lake.

On the plot of the first series of observations the discharge of Dec. 16, 1891, is marked doubtful, and occurs at local gage height 1.83 ft. The observations at and above this gage height during the second series prove this result to be reasonable and in fact very close to the mean discharge value, as determined by the computed curve. The gage readings on the two gages, during the first series, suggested that mean lake level was equivalent to a local gage height of about 2.1 ft. The equation of gage relation, based upon the observations of both series, gives 2.087 ft. on the local gage as a mean determination of the equivalent to mean lake level.

It is true that the mean discharge curve is based upon a limited number of observations, but it is not probable that a greater number of observations would materially affect the values of the equation constants. The maximum variation in the measured discharges for the same height, is about 7% at gage height of 2.0 ft. In no other instance for approximately equal gage heights does the variation in discharge exceed 4%. It is not probable that the variation would ever exceed 10%.

The mean discharge at mean lake level as determined by the equation, is 230,280 cu. ft. per second. It is to be regretted that the lake level during the time of observation did not reach well above mean lake; for, while the equations will, no doubt, give fairly approximate results for higher levels than the extremes observed, they cannot be regarded as reliable as results based upon direct observations. A discussion of the equation indicates that between gage heights 0.0 ft. and 1.0 ft., the discharge increment for a change of one foot is about 37,500 cu. ft. per second; between 1.0 and 2.0 ft. the discharge increment for a change of one ft. is reduced to 25,000 cu. ft. per second, and diminishes rapidly. At a local gage height, 3.0 ft., equivalent to +1.9 ft. on the Buffalo gage; the equation indicates a discharge of 241,468 cu. ft. per second. At this stage the river has reached the level of its bank on the Squaw Island side, at the discharge sections, and the lower end of the island is flooded. A maximum discharge of about 243,500 cu. ft. per second is indicated at a local gage height 3.5 ft., equivalent to Buffalo gage height +3.0 ft. At a local gage height of 4.0 ft., equivalent to Buffalo gage height +5.0 ft., the equation indicates a discharge of 241,896 cu. ft. per second. From this point the equation gives decreasing discharges. In the absence of observed values, which would have great weight in determining the discharge curve above mean lake level, I am not prepared to admit that the discharge and gage-relative values at these high levels are more than approximations.

THE PRICE CURRENT METER.

In this issue is published the latest measurement of discharge of the Niagara River, as ascertained by the United States Engineer Corps. The instrument so successfully used in determining the

Price's Current Meter.

velocity of the river was the Price current meter, and as an addendum to that article, and in answer to several late inquiries, we publish a cut and description of this instrument, as furnished at our request by the makers, Messrs. W. & L. E. Gurley, of Troy, N. Y.

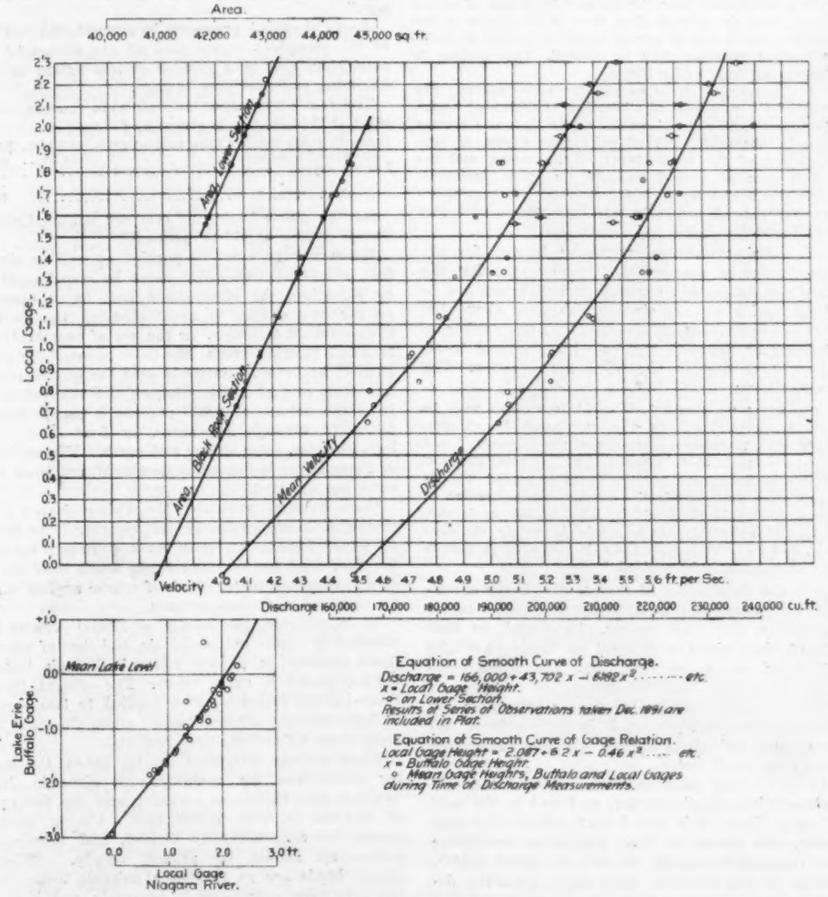
This device was invented by Mr. W. G. Price

while in the employ of the United States Engineer Corps, on the Ohio and Mississippi rivers, and was patented Aug. 25, 1885. The wheel of the meter carries five conical buckets so arranged as to feel the force of the slightest current and cause the wheel to revolve. The ends of the axis of the wheel revolve in bearings contained in metal air chambers, and are thus protected from the water and gritty matter. The upper end of the axis of the wheel extends above its bearing, entering an air-tight metal box, and is cut down for a small distance, through the diameter, one-half of the end of the shaft being cut away, and this piece then replaced with a thin slip of ivory between the two parts, insulating them from each other. Upon this divided part of the axis bears a light spring, which successively makes and breaks the electric circuit as the wheel revolves. The spring and divided axis just described form the contact-breaker, and are both contained in the little metal air-tight box, as shown in the cut.

A hollow cylinder of bronze, termed the trunnion, fitting easily upon the rod, supports the frame of the meter by a pivot on each side, and thus by the rod and pivots the meter is free to move both horizontally and vertically, and so adjust itself to the direction of the current. The frame of the meter is made of bronze, and is very solid and strong. The rudder has four light metal wings, or vanes, screwed into a brass socket in the lead weight at the bottom and secured thereon by a jam-nut. A sliding ring of metal, with set screw, as shown, allows the meter to be raised to any point on the rod.

The bottom weight is of lead, and weighs about 60 lbs.; it has a rudder of wood, as shown, secured to the weight by brass cheek pieces, which are also securely fastened to the weight by sockets cast into the lead. The rudder can be set at any angle with the weight, or turned up parallel with the rod, for convenience in transportation. The weight is only used where the meter is employed in deep water and harbor surveying, where the currents are very strong. In shallower water the meter is suspended upon a rod of wood or metal, and this may be in one piece, or formed of several short rods screwed together.

The number of the revolutions of the meter wheel is recorded upon an electric register carried on the tug boat and actuated by a battery of two or three cells. The electric current, from one pole of the battery, is carried by an insulated copper wire down through the trunnion of the meter and thence up the insulated binding post on the upper arm, through the contact breaker, the axis of the wheel and the lower arm, to the binding screw on that arm. From this screw a second copper wire passes up through the trunnion to one binding-post


Area.
40,000 41,000 42,000 43,000 44,000 45,000 sq. ft.
Local Gage.
Area.
Mean Velocity.
Discharge.
Velocity 4.0 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 5.0 5.1 5.2 5.3 5.4 5.5 5.6 ft. per Sec.
Discharge 160,000 170,000 180,000 190,000 200,000 210,000 220,000 230,000 240,000 cu. ft.
Mean Lake Level
Lake Erie, Buffalo Gage.
0.0 1.0 2.0 3.0 ft.
Local Gage Niagara River.
Equation of Smooth Curve of Discharge.
Discharge = 166,000 + 43,702 x − 6882 x² ..... etc.
x = Local Gage Height.
-o- on Lower Section.
Results of Series of Observations taken Dec. 1891 are included in Plat.
Equation of Smooth Curve of Gage Relation.
Local Gage Height = 2.087 + 6.2 x − 0.46 x² ..... etc.
x = Buffalo Gage Height.
Mean Gage Heights, Buffalo and Local Gages during Time of Discharge Measurements.

SMOOTH CURVES OF DISCHARGE, NIAGARA RIVER.

secured to a central rod, and is made to balance the weight of the wheel and give direction to it, and thus keep the wheel in both directions in line with and its buckets opposed to the current. This meter frame has a hinged side secured by a spring key, allowing the meter and trunnion, which is itself in two parts, to be detached from the rod when desired; in the older form the trunnion was left on the rod.

The connecting wires are passed upward through the trunnion of the meter, and so have no tendency to pull the meter out of the line of the current. The rod is of brass, ¾ in. in diameter, and 2 ft. long, its upper end having an eye of brass screwed firmly on and pinned, and its lower end of the register, and thence through the register to the other binding-post, and finally by another wire to the second pole of the battery.

The electric register shows two dials, and when the circuit is made an electro-magnet moves a lever, at the end of which is a pawl carrying forward a ratchet-wheel, one tooth at each break in the circuit. The dials are each divided into 100 spaces and figures to the right. The right-hand dial counts to 100 and the left-hand dial to 10,000 each space on the left dial representing 100 on the right dial. The register is shown on the cut.

Two sizes of these meters are made, the larger having a wheel 7½ ins. in diameter, and the other a wheel of 6 ins. The larger meter, including the rudder-vane, is about 35 ins. long; the other is about 24½ ins. long. The larger size is used for deep-water and harbor surveying, where great strength is required and the weight is usually employed with it. The smaller meter is intended for use in smaller rivers and streams, without the weight. The aggregate price of a meter of either type, the electric register and the lead weight, is $165. The three-cell Leclanche battery costs $7, and the jointed brass tubing, in 4-ft. lengths and graduated in feet and tenths to use without weight, costs $1.25 per foot.

THE ABT RACK RAILWAY IN SYRIA.

We are indebted to Mr. W. Hildenbrand, of New York, N. Y., the American representative of the Abt system of rack railway, for the following details of the proposed railway between Beirut and Damascus, Syria, about 20 miles of which, over the Lebanon and Anti-Lebanon mountains, is to be operated on the Abt rack system. In an article describing the various railway lines in Asiatic Turkey in our issue of Dec. 15, 1892, we gave a brief description of this proposed line. It is intended to connect Damascus, situated in the center of the fertile plain lying west of Anti-Lebanon Mountains with the city of Beirut, on the Mediterranean, the principal seaport and great entrepot of Syria, both for traffic from the East and the West. These two cities have populations of about 200,000 and 120,000, respectively, and both are seats of considerable commercial and manufacturing activity, although the commercial prominence of Beirut is due largely to the fact that it is the nearest seaport town from Damascus and the rich country of which that city is the commercial center.

The only means of communication between Beirut and Damascus is a military road, 75 miles long, built by a French company some 30 years ago. While this road has been exceedingly profitable, the demand for better transportation facilities has gradually increased with the commercial growth of Damascus, and this, together with the fear of encroachment by the English in a field looked upon by the French as especially their own, has led the French capitalists interested to take active steps toward the construction of a steam railway. The chief difficulty hitherto has been to secure the necessary financial backing. This, we are informed by Mr. Hildenbrand, has been secured to the amount of $6,000,000, and the contract for the construction of the line, let in August, 1892, to a French contractor who has begun work.

The railway line will be 87 miles long, or 12 miles longer than the present wagon road, and of this, 20 miles, as before stated, will be of the Abt rack type. It begins at Beirut, at about sea level, and rises in the first 20 miles, which take it to the great watershed of Hamra, in the Lebanon Mountains, to an elevation 4,820 ft. above sea level. From this point the rise is about 240 ft. to the mile to the point of beginning the descent to the central station at Maallaka, 3,000 ft. above sea level and 37 miles from Bierut. The 50 miles from Maallaka to Damascus will be operated by adhesion. The gage of the track will be 3 ft. 5 ins. The smallest radius of curve for adhesion will be 328 ft., or a curve of 17° 32', and the shortest radius for rack will be 398 ft., or a curve of 14° 26'. The heaviest grades for adhesion will be 2½%, and for the rack, 6% going toward Damascus and 7% going toward Beirut. On the 6% grades the train loads are limited to 100 gross tons, and on the 7% grade to 80 gross tons. The locomotives will weigh 43 gross tons, with 32 tons on the adhesion drivers. They will be manufactured at Winterthur, Switzerland. The rack rails will be manufactured at Dortmund, Westphalia. The cost of the road is estimated at $70,000 per mile.

In addition to the above information furnished us by Mr. Hildenbrand, it should be noted that some of the English technical papers throw doubts upon the bona-fide character of this French enterprise, and imply that the beginning of construction noted above was merely the formality of "turning the first sod" to secure financial backing. These statements are themselves open to question, however, as a British company is financiering a scheme which has for its object the construction of a railway through practically the same territory, and between which and the French enterprise there is a bitter rivalry.

SEWAGE TREATMENT AND SLUDGE DISPOSAL.

American experience in the purification of sewage is limited to the past few years, and our practice is largely founded upon what has been done in England and the continent of Europe. Some of the latest English views on this subject are presented by Mr. W. Santo Crimp, M. Inst. C. E., Engineer to the London County Council, in a small pamphlet entitled "Sewage Treatment and Sludge Disposal," from which the following has been abstracted:

In discussing very briefly the character of street washings as affecting sewage or the pollution of streams, Mr. Crimp gives analyses of two samples of liquid flowing off the surface of streets in the center of London during a rain. One of the streets was paved with wood and the other with macadam. The results of the analyses, changed from grains per imperial gallon to parts per 100,000, are as follows:

	Kind of Pavement. Wood.	Macadam.
Appearance	Dark color.	Slate color.
Odor	Strong urine.	Urine.
Chlorine	54.00	24.40
Free ammonia	6.86	3.54
Albuminoid ammonia	4.25	2.48
Oxygen absorbed by matters in solution in 15 minutes	0.68	0.38
Oxygen absorbed by matters in solution in 4 hours	4.95	2.81
Suspended matter { Mineral	980.57	2,020.57
Suspended matter { Loss on ignition	83.43	77.71
Dissolved solids { Mineral	462.14	178.57
Dissolved solids { Loss on ignition	117.14	38.57

An important consideration in connection with sewage purification plants is the relative amount of sewage which may be expected during different parts of the 24 hours. The following figures give the results of observations at the localities named:

	Maximum percentages discharged. 7 p. m. to 7 p. m.	During 8 hrs.	During 6 hrs.	During 1 hr.	Excess of maximum over mean discharge, per cent.	Gallons* per head per day.
Aylesbury	56	42.2	31.4	5.9	42	60
Leicester	60	42.8	31.3	5.7	37	42
London	68	49.0	37.0	6.6	60	35
Providence	61	42.0	33.0	5.6	35	..
Wimbledon	66	48.2	39.5	7.4	78	20
Averages	62	44.8	34.4	6.3	50	..

(*It must be remembered in this discussion that the consumption of water in English cities is very low compared with the consumption in this country.—Ed.)

As to the effect of rainfall upon the volume of flow in a combined system of sewers, the results of gagings of the Wimbledon outfall sewer flow by Mr. Crimp are given as follows:

.19-in.	rainfall	increased	the	flow	5 times.
.21	"	"	"	"	4 "
.23	"	"	"	"	5 "
.24	"	"	"	"	5 "
.29	"	"	"	"	8 "
.67	"	"	"	"	10 "
.92	"	"	"	"	12½ "

In the last case the rain fell with great intensity, and the maximum flow in the outfall sewer occurred in 13 minutes after the rain began.

The above figures, the author states, show the necessity for separating the rainfall from the sewage, so far as possible, when the sewage has to be treated. In urban districts the treatment of storm water, as well as sewage, is recommended, on account of the gross pollution of streams caused by street washings, which, we may add, is well illustrater by the analyses of London storm water given above.

In designing settling tanks it is recommended, in order to save labor in cleaning, that the cross-section of the bottom of the tank be segmental, and that there be a longitudinal fall of about 1 in 100 toward the inlet. At the outlet end a weir should be provided, and in addition a floating arm-valve for removing the clarified sewage down to the sludge level. Where the sludge is to be pressed ¾-in. gratings should be provided to remove large substances, which might give trouble in pumping.

From his experience at Wimbledon and in connection with the great volume of sewage treated at London, Mr. Crimp concludes that "the continuous flow system is generally superior to the intermittent" for the settling tanks.

The above opinions refer to settling tanks as generally constructed in England. The author refers to two other types of settling tanks, as follows:

An exceedingly useful form of tank has recently been designed by Herr Kuiebuhler, Engineer for the sewage works of Dortmund. These tanks are certainly constructed on better lines than are the English tanks. They are circular on plan, and are of considerable depth, the bottoms being in the shape of an inverted cone. A large cylinder is fixed vertically in the middle of each tank. The sewage, after passing through roughing tanks in which the sand and other heavy matters subside, is treated with lime and sulphate of alumina, and is then discharged into the central cylinder, down which it passes nearly to the bottom of the tank, and it is then distributed in a horizontal direction by means of specially constructed arms. The heavier solids fall to the bottom, while the lighter are carried upward for some distance, where they remain suspended in the water, forming a filtering medium. These particles then aggregate together, and by reason of their then greater specific gravity, fall to the bottom, while the clarified effluent overflows into a network of channels placed near the top of the tank. Perhaps the most interesting feature in connection with these tanks is the facility with which the sludge can be removed, even while the tanks are full of water. Passing down the central cylinder, and reaching nearly to the bottom of the tank, is a pipe 6 ins. diameter, connected with a large iron reservoir, from which the air is exhausted by means of an air pump. The sludge then rises until the reservoir is nearly full, when by a suitable arrangement of valves, its contents are discharged into sludge drying beds.

At Essen, tanks on a somewhat similar principle have been constructed, but the tanks, instead of being deep like those at Dortmund, are shallow, and a large iron vessel like a gas-holder is placed in each of them. The air is withdrawn from the cylinder by means of an air pump, and the sewage then rises to the height of the syphon outlet, and so long as a partial vacuum is maintained, a constant flow is secured. This system is known as the Rockner-Rothe.

In the opinion of the author, these two systems are worthy the attention of all having to design or superintend sewage disposal works, as by their use sewage can be chemically treated quite near towns, in consequence of the compactness of the works, and the small area of ground required. In very inclement countries, and those in which extremes of temperature are experienced, the tanks may be roofed in at a very small cost.

Concerning chemical processes in use for the purification of sewage, Mr. Crimp states that the first patent in this connection was taken out in 1762 by Deboissieu, since which date about 450 patents have been obtained. The vast number of failures or negative results with chemical treatment have greatly simplified the question. The author says:

The exact position (of chemical treatment) may be briefly recapitulated in the words of Dr. Dupre, F. R. S.: "As regards processes of precipitation, I will merely remark that, inasmuch as no proportion of chemicals which can practically be employed will do much more than clarify the sewage, the proportion of chemicals employed should be kept as low as is consistent with the object to be attained, namely, clarification, and that more particularly the use of large quantities of lime should be avoided."

For the clarification of sewage lime is the chemical most commonly used, probably because of its cheapness and effectiveness. It should be first slaked, then mixed with about ten times its weight of water, the usual dose being about one gross ton per million imperial gallons of sewage, or about 13 grains per United States gallon. When circumstances will permit, it is preferable to use lime water with about 6.7 grains of lime per United States gallon of water.

In case a very alkaline sewage effluent comes in contact with organic matter, as found in the mud of many rivers, it is stated that putrefaction may result. An excess of lime may even precipitate the suspended organic matters in river water, which, in hot weather, may cause offensive deposits.

London sewage is treated with lime water in the ratio of about ¼ gross ton of lime per million imperial gallons of sewage, or about 3¼ grains per United States gallon, after which 5.7 grains of protosulphate of iron per United States gallon is used. The process is simple, cheap and effective. At many sewage disposal works 6⅔ grains of lime and 5 grains of sulphate of alumina per United States gallon are used. In the "Amines" process about two gross tons of lime per million imperial gallons, or 26 grains per United States gallon are used, together with a small amount of herring brine. The principal object sought by this process is sterilization of the effluent, but clarification and deodorization are effected.

In the "A. B. C." and "International" processes lime is not used, alum, clay and charcoal being extensively employed in the former, and in the latter the sewage is first treated in tanks with ferrozone, after which it is passed through small polarite filters at the rate of about 600 United States gallons per square yard of filtering surface per day. Mr. Crimp states from personal experience that an effluent from sewage which had received the London treatment, described above, was rendered non-putrescible by passing it through a polarite filter at the rate just named, but adds that excellent results were obtained with the same rate of filtration through such materials as pea gravel, burnt clay and coke breeze, the latter giving nearly as good practical results as the polarite. In passing sewage effluents through filters, it must be remembered that the organic matters in solution are broken up by micro-organisms, some of which require air, so that the filters require frequent aeration.

Regarding the production of a sludge of manurial value, which is claimed for the "A. B. C." process, the best example of this method is said to be at Kingston-on-Thames, where the local authorities pay the company treating the sewage by this process an annual amount equal to 3d. in the pound, 1¼%, on the ratable value of the district. "This fact," Mr. Crimp states, "is more eloquent than volumes, as to the supposed value of sewage."

As to chemical processes in general, the author of the pamphlet states that all are successful in clarifying, and to a greater or less extent in deodorizing and purifying sewage.

The cost of the lime and alumina process, once used at Wimbledon, is given, as follows:

Lime, ½ gross ton per imp. million galls. at $4.86.		$2.43
Sulphate of alumina, ⅓ " " " 14.58...		4.86
Labor, say		1.22
Total		8.51

On the above basis, the cost per million United States gallons would be about $6.

When sewage must be purified as well as clarified, chemical treatment must be supplemented by filtration, the clarification first being carried as far as possible, to avoid clogging the filters. Concentrated filtration, or the use of comparatively small filtering areas, has been successfully employed. At Acton, polarite is used for concentrated filtration, and at Friern Barnet, the tank effluent from the sewage of 8,000 persons is passed intermittently through 1⅓ acres, in four filters, of burnt ballast, coke breeze and earth. The surface of these filters is dry when harrowed, and good results are reported.

Upon hygienic grounds, Mr. Crimp favors the clarification of sewage before applying it to land or sewer farms, but gives as a principal reason the fact that heavy rains bring much solid matters to disposal areas, which of course applies only to combined sewerage systems.

At Wimbledon, the sewage of 22,000 persons is clarified by tanks and chemicals, and that of about 3,000 persons is passed upward through burnt ballast placed in small tanks. The effluent from these ballast filters is often applied to two acres of land without offense, except when the land is being dried off and the crop removed.

When sewage is applied to clay lands, the latter should not be underdrained, since in dry weather this facilitates cracking and the passage of sewage without purification. Clayey lands should be very carefully leveled, and whenever broken up should be plowed deeply. When clayey lands are so treated a suitable home for the nitrifying organisms is provided; and if the sewage is first clarified, if only by means of filters like those of Wimbledon, just described, the sewage of 250 persons may be purified on one acre.

Underdraining is of value in connection with gravelly and other porous soils. The author states that "it is generally accepted that the clarified sewage of 1,000 persons may be treated" on one acre of such land.

The financial results of sewage farming at Wimbledon are summarized as follows:

Total working expenses, $44 acre; total receipts, $63 per acre; but as the land cost upward of $1,450 per acre, the result is a loss to the ratepayers.

The amount of sludge produced at Wimbledon in 1888, from 438,000,000 United States gallons of sewage, one-fourth of which was due to rain

water and subsoil leakage, was 3,416 net tons of sludge cake, or 6.96 tons of cake per million United States gallons of sewage. If all the water had been dried out there would have remained 3.4 tons of sludge per million gallons, or 49.7 grains per United States gallon, of which 10 grains represented the lime and carbon, and 4 1-6 grains the sulphate of alumina used as a precipitant.

From the London sewage about 2.8 net tons of sludge per million United States gallons is derived, the quantity of chemicals used being small. But this gives a weekly production of about 44,800 net tons of sludge, or 50,000 cu. yds., all of which is transported 45 miles to the Barrow deep, at the mouth of the Thames, by means of five steamships, each carrying about 1,120 tons per trip. The average cost of transferring upward of 2,240,000 tons has been about 5½ cts. per ton.

At Birmingham, about 224,000 tons of sludge per annum is buried in the earth, it being first elevated to troughs which convey it to any part of the land, then deposited in shallow beds formed by banks of earth; after solidifying for about two weeks it is spaded under. About one acre of land is used for each week's sludge, and the same land is used again in three years. This method of sludge disposal at Birmingham costs about 6.2 cts. per net ton for labor, plant, etc., and crops grow well upon the land.

Regarding the use of the Johnson filter press,* it is stated that sludge produced by the lime process is the most readily pressed. But if little lime is used in the tanks, as much as 2% of the volume of the sludge may be required to so destroy its glutinous nature that it may be rapidly pressed. Compressed air is regarded as the best means of forcing the sludge into the presses. Direct-acting pumps have not always been successful on account of clogging of the valves.

* The Johnson filter press is used in this country at East Orange and Long Branch, N. J. See Eng. News, Jan. 5 and 19, 1889, and Dec. 1, 1892, for description of East Orange disposal works, and Dec. 22, 1892, for Long Branch.

The cost of compressing 250 gross tons of wet sludge into 50 tons of cake at Wimbledon was as follows:

Wages	$10.94
Lime, 50 cwt. (gross), at 24.3 cts.	12.15
Coal, 6 cwt. (gross), at 18.3 cts.	2.91
Cloths	3.89
Oil and incidentals	.49
Total	$30.38

The cost per gross ton of sludge cake on the above basis was about 61 cts., or about 54 cts. per net ton.

At Ealing, sludge is mixed with town ashes and burnt in a refuse destructor, and at Southampton it is mixed with street sweepings and garbage and sold as manure.

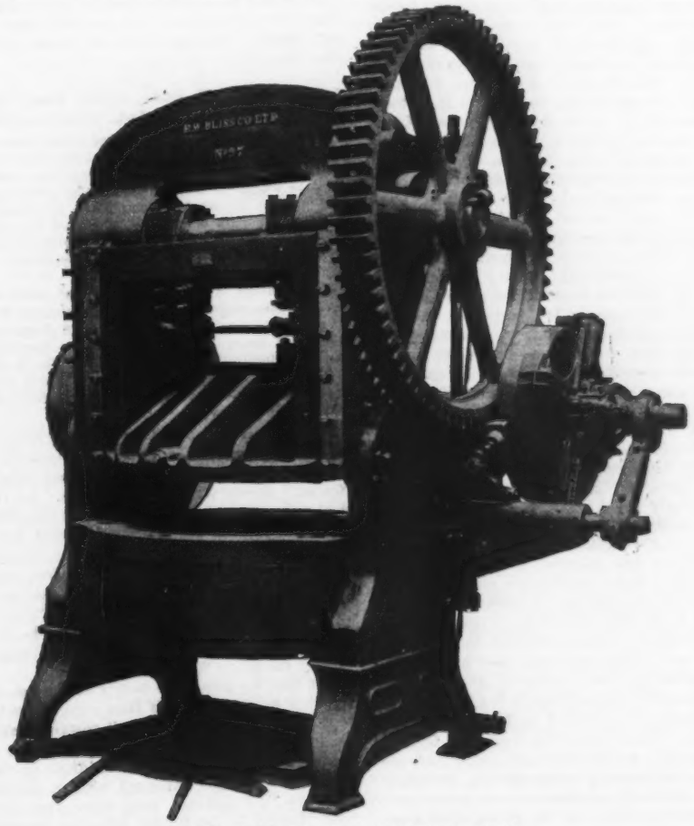
PRESS FOR CUTTING ARMATURE DISKS.

We illustrate herewith a heavy power press built by the E. W. Bliss Co., of Brooklyn, N. Y., for the Schenectady shops of the General Electric Co. The press is intended for punching from sheet metal the disks for armatures of electric motors and dynamos, and is designed to work with the greatest accuracy so as to make the disks of absolutely uniform size.

In order to give a firm support and accurate guidance to the large and delicate dies, the ordinary center gib has been abandoned, and the ways of the slide are spread apart so as to be as wide as the frame itself. This has also made it possible to lengthen the ways considerably without increasing the height of the frame. The cut shows very well the additional solidity and accuracy due to this mode of construction.

Another special feature is the application of a new automatic friction clutch, which obviates entirely many of the difficulties experienced with many of the regular positive clutches on heavy back-geared presses. Its application and construction will be understood from the cut. A pressure on the foot treadle releases a weight, which actuates a powerful friction clutch on the back shaft, thus starting the press almost instantaneously and obviating entirely the heavy metallic blow which, in the ordinary clutches tends to destroy the parts and frequently causes expensive delays and repairs. After the shaft has made one complete revolution the cam releases the friction clutch, bringing into action at the same time a brake, and thus stopping the slide at the highest point of the stroke. There is nothing about these clutches which is liable to get out of order; for whatever wear may be occasioned by continuous use, easy means of compensation is provided. The large gear wheel, instead of revolving continually, as in the ordinary type of press, is with these new clutches keyed on the shaft, and stands still until the clutch is thrown into action. This constitutes an additional advantage in the saving of considerable wear on the shaft and wheel hub.

This press will cut armature disks 30 ins. in diameter and upward. It has a distance between the housings of 54 ins., and is generally made with a 30-in. round opening in bed, which, however, can be varied to suit special requirements. It is geared 1 to 10, and has a flywheel weighing 1,800 lbs. on the back shaft. The weight is 30,000 lbs.



PRESS FOR CUTTING ARMATURE DISKS.

NOTES FROM THE ENGINEERING SCHOOLS.

Dr. R. H. Thurston, director of Sibley College, Cornell University, writes us as follows in regard to their length of college year, which was originally reported to us as 40 weeks, while we found it only 34 weeks by the face of the college calendar:

I have just noticed that you find a discrepancy between the reported length of our college year and that given in the register. I do not know, of course, just how it happened; but I presume it was through taking the college-year as measured by the interval between its commencement in September and its close in the Commencement week in June. (This does not appear to account for more than three of the six weeks' discrepancy.—Ed.)

The fact is that we are, in some departments, busy without cessation throughout the whole period, and the vacations simply give a little more time for laboratory and shop-work, and sometimes other matters, that cannot be had during the regular term-time. Our shops are full all through the shorter so-called vacations of the University at large, and also through the months of July and September; while many students work right on through August as well. You will find in our "Register" the advice to students to do this, rather than attempt to take this work in term-time in addition to the studies of the course which constitute in themselves alone quite as much work as should be undertaken by the average student, and more than is ordinarily demanded in literary courses in the average college. I should therefore say that the standard literary course gives its diploma on about 540 hours of total actual work, usually not difficult or engrossing, while the technical course involves something over 675, probably over 700, and, with us, at least, it is generally supplemented, by the best men, with as much more as time and strength and the opportunities of nominal vacations permit.

I think, however, that the literary and the technical departments are mutually influencing each other for good; the former holding up the latter to a better idea of good execution of the literary parts of their work, and the latter giving the former some idea of what is meant by hard, business-like work, and solid returns. More and more students are also deferring their professional work to a later period when they can come to it mature and strong and well-grounded in the elementary preparatory work, and, meantime, getting a good education, in the proper sense of that term.

We appreciate the force of these statements, and have no doubt they apply in substance to various other schools, whose apparently short years are modified and informally extended in the same way. All colleges, we believe, have the constructive "hour" system. Still there remains another side, which we will not now take time and space to discuss.

On the general question of long or short vacations, with especial reference to the Thayer School of Civil Engineering, Prof. Robert Fletcher writes us as follows:

Sir: With the general drift of your comments on long vacations and short terms for engineering schools, we are in close agreement. It is well, indeed, to "see ourselves as others see us"; but in case all the facts are not in view, some conclusions may need modification.

1. The Thayer school week includes eleven half days. Nominally, Saturday afternoon only is half holiday; but even part or all of that is sometimes devoted to work by students and instructors. Hence, if comparison is to be made with institutions which allow an entire day off each week, we should be credited with three weeks more each year, making our course one of 72 instead of 66 weeks.

2. For the instructors the school year extends from Aug. 1 to the last week in April—38 weeks, including a brief recess at Thanksgiving and one at Christmas, of about eight days; total aggregate, about 40 weeks per

year on the five-day basis. As to the students, the entering class, beginning Aug. 1, has 37 weeks in the first year. Of late years, our few students have found valuable (instructive) engineering employment during the summer; all of them. Hence, we do not count out the summer vacation as so much lost. As a class, they usually report for duty about Sept. 15 to 21, making the second year in the school from six to seven weeks shorter than the first year. For these reasons 72 weeks for our school course is the proper figure comparatively, even without considering that the vacation work is the most valuable kind of practical work, and might be offset against the "practice" item of some of the schedules elsewhere.

3. As to the diagram for Thayer, published Jan. 12, it does not accord with the corrections sent you for tables XXXIII. and XXXIV., a few weeks ago—nor with any data sent; for no chemistry is included in our course—it being among the requisites for admission. The tint indicative of "surveying" should cover the entire extent of 15 weeks, including both elementary and advanced work under that head (group D.).

Again, expressing my appreciation of the great value of these articles, and the belief that they cannot fail to lead to far-reaching changes for the better in some departments of technical training, I am,

Respectfully yours,
Robert Fletcher.

We thank our correspondent for his kind words in regard to the purpose and result of our recent series of articles. That they were intended to be helpful, and only that; to dwell upon supposed bad features only to remedy them, and to recognize good motives even in bad results, has, we trust, been clear. We wish that we could, in return, recognize the validity of the main argument of this letter as to a constructive increase in the number of weeks in the year because of an alleged excess in the hours per week, but we cannot. Not only Thayer, but several other colleges have claimed that their course should be considered constructively longer because they have a 6-day or a 5½-day week, yet the argument seems to us transparently unsound. The week, and not the day or the year, or the hour, is the proper unit of college work, for comparative purposes at least. Does not each college calculate to demand of its students each week as much work as their average limit of elasticity will permit? Was there ever student, not of the sternest religious principles, who did not use Saturday and Sunday too, as he found occasion, for catching up arrears or easing the burdens of the coming week? Is there any difficulty in arranging a week's work, so as to demand an equal amount of work from the students, even if the formal class exercises were cut down to a single day per week? Where, then, is the justice of considering at all whether the formal exercises are confined to 5 days or 5½ or 6 days, or 5 days with two halves? To the professors, indeed, it makes some difference, but to the students not a whit, unless it be that they are a little more apt to be overstrained by an equal quantity of work when the rigid part of it is extended over six days than when it is confined to five. Therefore, we suspect that it is a grave error to extend scholastic exercises at least over more than five days. Even when the sixth day is used for field exercises, as at the Massachusetts Institute of Technology and many other schools, though it looks as if this field practice was so much clear gain, it is only partially so. It detracts in some measure from the scholastic load which the students' backs will bear for that week, and hence does not result in sensibly more progress per week than if all the formal exercises, fieldwork and all, were confined to five days, and the seventh and first day of the week left free for any use the student desired to make of them, according to his needs. Not that we should be understood to recommend this course; there is something to be said for either plan, and much in favor of the Saturday field exercises. We only say that there is no essential difference between them in their potential results. The week is the natural and inevitable unit of student capability. The problem must ever be to give to each week its proper work, whether it is exacted only by periodical examinations or by daily class exercises. That done, all mere matters of class hours matter nothing. That undone, the nominal class hours certainly amount to nothing.

As to the diagram, metallurgy was reported, if chemistry was not; and the diagram shows 12 weeks of surveying (instead of 15), which was all the figures we had in hand seemed to warrant. Possibly some later figures were overlooked. With every desire to seek accuracy in every way, later corrections sent in at all sorts of times, in all sorts of ways, to suit the sender's convenience, sometimes had this fate.

A brand-new example of this difficulty comes pat to our hands. We give it in all good nature, and admit the error charged in it, pleading only that it was purely typographical, as the original copy for the table was carefully checked.

It is on you this time! In the table on page 40 (Feb. 9), all vacation and college years add up 52, except the University of Illinois, where 16 + 34 = 50. However, in that particular year you might have found a deficiency of two days, on account of Christmas coming early in the week. Yours, A. N. Talbot.

P. S.—There are 52 weeks in an Illinois year.

A single added line would have given the correct figures. For lack of it, we have no way, at this writing, of knowing just where the error lays, except to go uptown, find the proper catalogue, make a new calculation from the calendar, and so on. Therefore, so far as we are concerned, the Illinois year must continue to stand as having only 50 known weeks! Our impression is that the true figures should have been 16 + 36 = 52, making the return of college year, as originally made to us, correct; but for aught we know, it may be 18 + 34 = 52.

President H. T. Eddy, of the Rose Polytechnic Institute, Terre Haute, Ind., writes as follows:

May I beg to say that, having been connected with several institutions, I have found the faculty in each case quite willing to make the teaching year a long one—40 weeks—if they could thereby sensibly increase the amount of work accomplished by students. But in fact, students cannot be compelled by any known process to get lessons after the weather becomes hot in June, nor to start with energy in September until the heats of summer are passed.

Yale College is a good example of what has been done in this respect by the gradual change of the date of commencement from the middle of August 40 years ago, to a point at present some two months earlier. Southern institutions are especially liable to find themselves forced to have a short year. I think you do not do faculties strict justice when you put the responsibility entirely upon them.

On this much disputed issue of the proper length of college year we shall have something to say later in a discussion of "The Ideal Engineering School," which will shortly appear. As this will deal only with what should be, and not with what is, still less with the reasons for what is, we will only say here that we do not put the responsibility for what is upon any individuals, but only upon circumstances. Nor have we urged that any effort should be made to compel students to "get lessons" after hot weather begins in June. Is there no other work done, and to be done, at engineering schools except to "get lessons"?

Not that we admit the reality of the hot weather inability to get lessons, if that were the only alternative to doing nothing at all toward making the student an engineer. Remembering, as the present writer does, his boyish school days in the '50's and '60's, when he managed without serious difficulty to "get lessons" year after year from the first Monday in September till after the middle of July, such a claim seems absurd. Certainly he never dreamed of thinking that his six weeks' vacation was not all that he needed, though, of course, it was not all he would have liked; and if growing boys of 8 to 14 can stand 43 weeks per year of hard scholastic work without suffering any discoverable injury, the plea that hale young men who have attained their growth, and are in the very prime of their physical vigor cannot be made to "get lessons" even 40 weeks per year, if it is considered proper that they should do so, seems a trifle absurd. Has the race become emasculated in a single generation? The athletic records do not seem to show it. But boys and men alike can easily persuade themselves that what they do not greatly care to do would greatly injure them to do, and the precedent once well established, is hard to disestablish. Fortunately, no position we have taken requires us to do so. We have not disputed, and will not dispute, that even 34 weeks per year of hard persistent "getting lessons" is enough for engineering students.

Professor Eddy also sends us a correction of the diagram of distribution of time to studies, published Jan. 12, showing a greater amount of time for the "collateral" in English and general studies of the course, with correspondingly less of "advanced technical." We hope to give some entirely new diagrams of this kind within a year.

A NOVEL RAPID TRANSIT SCHEME FOR BOSTON.

Boston, Mass., is hard at work on the rapid transit question, and many plans have been submitted, including one by the Rapid Transit Commission. One of the most novel plans, and one containing some very good features, is that lately submitted by Mr. S. D. Hannah, of Boston.

Mr. Hannah bases his plan on a figure-of-eight arrangement, as shown in the smaller cut, with four tracks. This arrangement, as laid down on the map of Boston, would tap all the steam railway

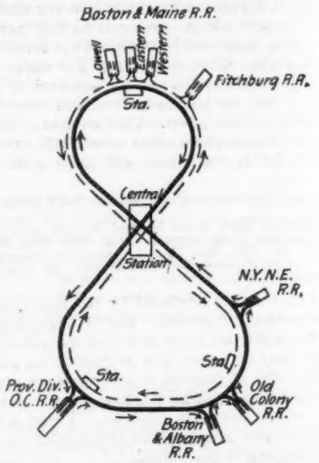


Diagram of Hannah's Plan for Rapid Transit Railway for Boston, Mass.

stations, and permit the entering and leaving of all trains at a central station near the City Hall. He proposes that all suburban trains of the steam lines should enter this underground system, and after making the circuit of all the other termini, again leave the system at their respective stations.

He describes the operation of the line as follows in the "Boston Herald":

The figure-8 arrangement allows all these trains to enter and leave the underground tracks from the line on the outside. This will be made plain by a study of

Map of Hannah's Proposed Rapid Transit Railway for Boston, Mass.

the smaller of the two plans published herewith. It will be noticed that the broken line is on the outside at the northern stations, but is on the inside and out of the way of the other tracks at the southern depots, so that they may be used for the trains from those roads.

Thus a train on the Lowell road, from any of the northern railroads, passes on to the outside of the four underground tracks which are proposed, and keeps there until the center of the system is reached at City Hall.

Here it crosses all four of the tracks going in the opposite direction, and on the innermost line of all makes the circuit of the next half of the 8, crossing the tracks again, as before, at the center, taking the outermost of the tracks, where it is when its own particular road is once more reached.

If the train should take the innermost of the two tracks devoted to its section, a crossing of the outermost at the point of entrance and exit would be necessary, but this could be arranged so as not to make a grade crossing. If all the southern and all the northern trains came into two union stations, these crossings would be avoided. In that case, two trains might simultaneously enter the underground system and pass through it in opposite directions without crossing any tracks except at the center.

The central crossing could easily be made safe on a tunnel line by a change of grade; and we do not agree with the statement that, as all trains must necessarily stop there, a grade crossing would be perfectly safe. The length of the proposed line, roughly measured, is under 4½ miles, and the estimated cost is $7,000,000 for a four-track system. At present 72 trains per hour enter Boston, or 18 per hour for each of the four tracks.

Mr. Hannah suggests that the steam railways unite to build this system, or lease the privilege of running on it from a separate company. But with the figure-eight arrangement, operated independently of the other lines, by exchange, a double-track, constantly circulating line would seem to be cheaper, and would meet the conditions about as well as the more complicated plan proposed, and with absolutely no grade crossings, as the lines need only approach each other at the center and not cross at all. It is true that for 72 trains per hour the headway would be less than two minutes for the two tracks, and tunnels under or over the inner track would be required at stations. But the difference in cost of construction and operation is worth considering.

UNFREEZABLE DYNAMITE.

The following is an abstract of a paper by Mr. E. E. Russell Tratman, of New York, which was read and discussed at the recent meeting of the American Institute of Mining Engineers at Montreal, a report of which is given in another column. It calls attention to an explosive which appears to have special advantages for use in cold climates, by obviating the dangers incident to the thawing of frozen cartridges:

The use of dynamite in cold weather is attended with some difficulty, owing to the freezing of the material and its consequent liability to fail to explode when the fuse is fired. With proper methods and care the dynamite can be thawed with reasonable safety, but numerous accidents occur (more than get reported in the public press), due to carelessness in the operation and to the treacherous nature of the material, or a combination of both conditions. Dynamite will stand treatment at one time which at another time will result in explosion. An expert on explosives says that the most dangerous means of thawing cartridges are ingeniously devised by ignorant laborers; baking, boiling and toasting being favorite methods, while at a stone quarry, in one instance, an apparatus was arranged for steaming cartridges over a pot of boiling water. In this latter case the nitro-glycerine leaked through the canvas cover and settled on the bottom of the pot, with the result that an explosion occurred, the water acting as a tamping to the charge.

The fact that small quantities of explosives containing nitro-glycerine will burn quietly and without explosion if ignited by direct contact with a flame, has led to the dangerously mistaken reasoning that merely heating the explosive can produce no ill effect. If a dynamite cartridge is ignited or placed in a fire it will probably burn harmlessly away, but if placed on a stove or in an oven, and gradually heated to its exploding temperature of 350° to 400° F., a violent explosion is almost certain to result, while before that point is reached the dynamite will become extremely sensitive to shock.

In England alone, from the beginning of 1872 to the beginning of 1890, there were reported 63 accidents due to improper thawing of dynamite, by which 50 lives were lost and 76 persons injured. Reference may here be made to the explosion of dynamite, Dec. 28, 1892, in a thawing apparatus at the works for commencing the Brooklyn end of the proposed New York and Brooklyn tunnel, by which 4 persons were killed and about 20 injured. According to report, the thawing was done by placing the cartridges on shelves in a chamber 6 ft. square and 8 ft. high, heated by a coil of steam-pipes.

An unfreezable dynamite, invented by Liebert, a German, has been used to some extent in Europe, and has been favorably reported upon by chemists and experts in explosives, and it would appear most advisable to test its practical efficiency in this country. The dynamite is made in the usual way, but its composition includes a chemical (isoamylic nitrate), by which its freezing-point is lowered from 40° above to 50° below 0°, F., while the explosive power is slightly increased and the sensitiveness to concussion slightly decreased. This dynamite, it is claimed, is not affected by damp; it may be kept for considerable time without deteriorating or losing its special properties, and its cost is little, if at all, in excess of that of ordinary dynamite. It is patented in the United States. It certainly seems that if there is a reliable dynamite, unfreezable, at very low temperatures, and procurable at reasonable cost, it should find a field for introduction in the United States and Canada, and that steps should be taken to insure its introduction, in the interests of life and property.

In the discussion several methods of thawing dynamite cartridges were referred to, but it was shown that they do not provide for carelessness on the part of the laborers who use them. Mr. J. T. Jones described an apparatus for thawing cartridges, consisting of a tin box with tubes, like a tubular boiler; the box is filled with water and heated by an ordinary lamp, and the cartridges are placed within the tubes. Mr. M. Penhale had utilized the exhaust steam of an engine for heating a chamber in which the cartridges were placed. Mr. W. B. Phillips did not believe that there was ground for believing that seepage of the nitroglycerine would occur in cartridges, and he had opened and ground up a number of cartridges without finding any evidence of such seepage. With rackarock the oil and the cartridges are kept separate in winter until the latter are to be used.

Dr. R. W. Raymond said that rackarock has a strong odor which affects the men, and he had had to give up using it. He thought there was no doubt that seepage of the nitroglycerine frequently occurs, and is a great source of danger in the use of dynamite. As this occurs largely when the cartridges are being thawed, an unfreezable dynamite would greatly reduce the danger. As to thawing apparatus, while many safe arrangements may be devised, there is no guarantee that they will be carefully or properly used, as a careless laborer, in a hurry to thaw out some cartridges, may disregard all precautions. Prof. W. P. Blake stated that in a case in his own experience the cartridges were placed on racks in a cabin, where they were thawed, but that an explosion occurred, owing, it was supposed, to some of the boys sent to fetch cartridges finding them not ready for use and lighting a fire to hasten the thawing. Mr. Woodworth said that in a dynamite storage room one box was left standing on end, and the glycerine seeped out from the cartridges and saturated the wood. Mr. Tratman referred to the use of a double box, with manure packed in the surrounding space, for storing dynamite in cold weather, as used on the Croton Aqueduct. At the works of the Londonderry Iron Co. (Nova Scotia) a double box, with mineral wool packing, is used to store the thawed cartridges. Mr. J. F. Torrance said he had used the ordinary warming apparatus, consisting of two tin boxes, one within the other, with hot water in the space between them, the cartridges being placed in the inner box, but he had found an oily film settled on the bottom of the box, being seepage from the cartridges. He thought many accidents were due to imperfect combination of the nitroglycerine with the dope.

The Manchester Ship Canal Co., according to the last directors' report, has expended so far $63,723,370, and the board estimates that a further expenditure is necessary of $10,651,125, or a total of $74,374,495 for the completed work. The general works are expected to be finished by the end of the present year.

PERSONALS.

Mr. Henry Buestrin, contractor, of Milwaukee, Wis., died Feb. 21.

Mr. J. G. McDonald, railway contractor, died at Nashua, N. H., Feb. 20, at the age of 60.

Mr. Frank P. Johnson has been elected City Engineer of Waltham, Mass., for the ensuing year.

Mr. Joseph W. Joplin has been appointed Superintendent of the Pontiac Water, Light & Power Co., Pontiac, Ill.

Mr. Alexander von Babo, consulting engineer of the American branch of the Siemens & Halske Co., has removed his office to the Bort Building, Chicago.

Mr. Edward B. Wall has been detailed for duty as Assistant to Mr. James McCrea, First Vice-President of the Pennsylvania R. R. lines west of Pittsburg.

Mr. J. K. Wilkes has resigned his position as City Engineer of Danbury, Conn., to accept that of Engineer to the Sewer Commission of New Rochelle, N. Y.

Mr. Rudolph Hering, M. Am. Soc. C. E., has been engaged to make a sanitary survey of the city of Louisville, Ky., with respect to water-works and sewerage.

Mr. C. A. Wilson has been appointed General Superintendent in charge of the operating and engineering departments of the Wheeling & Lake Erie Ry., with offices at Toledo, O.

Mr. William H. Melville, of the State Geological Department of Texas, died at Austin, Tex., Feb. 18. He was a brother of Commodore Melville, Engineer-in-Chief of the U. S. Navy.

Mr. C. A. Wilson, Chief Engineer of the Wheeling & Lake Erie R. R., has been appointed General Superintendent, to succeed Mr. W. B. Woodward, who has gone to the Cleveland, Lorain & Wheeling R. R.

Mr. Geo. O. Garnsey, architect, of Chicago, has been appointed Superintendent of Federal Buildings at Chicago, including the United States Building at the World's Columbian Exposition, vice Mr. M. E. Bell, resigned.

Mr. J. Q. Van Winkle has resigned his position as General Superintendent of the Terminal Railroad Association of St. Louis to accept that of General Superintendent of the Cleveland, Cincinnati, Chicago & St. Louis Ry.

Professor Barnard, of the Lick Observatory, is reported as having received a call from the Chicago University, and it is said that he will accept. Professor Barnard is now on a six-months' leave of absence on salary.

Mr. Howard C. Rogers, Vice-President of the Eddy Valve Co., of Waterford, N. Y., was married recently to Miss Ella R. Peckham, of Buffalo, N. Y., sister of Mr. F. A. Peckham, Western agent for Engineering News.

Mr. R. C. Berkeley, Jr., late Principal Assistant Engineer of the West Virginia & Pittsburg R. R., has opened an office in the Title & Trust Building, Chicago, and will make a specialty of railways, bridges and structural work.

Mr. G. R. Hardy, formerly Assistant Chief Engineer of the Boston & Albany R. R., and lately with the Lake Shore & Michigan Southern Ry., is now in charge of the improvements on the New York Division of the New York, New Haven & Hartford R. R.

Col. Richard Vose died at Nyack, N. Y., Feb. 25. He was born Sept. 2, 1830, at Whitesboro, N. Y. For 40 years he had been identified with the car-spring business, and was the inventor of several car-spring appliances. In 1868 he established the firm of Vose, Dinsmore & Co., which was merged in 1875 with the Valentine Car-Spring Co., of which he was elected President.

Mr. George C. Lord, a former president of the Boston & Maine R. R., died at Newton, Mass., Feb. 23. He was born at Kennebunk, Me., in February, 1823. He became connected with the Boston & Maine R. R. in 1866, when he was elected a Director, and continued to be a Director till 1889. He displayed such marked ability in the directory of the road that in 1881 he was elected President, which place he held until his resignation, on Jan. 1, 1889.

Mr. Allan Manvell, for some years President of the Atchison, Topeka & Santa Fe R. R. Co., died at San Diego, Cal., Feb. 24. He was born in Alexander, N. Y., in 1837, and received a common school education. In 1859 he went to Chicago and entered the employ of the Chicago, Rock Island & Pacific R. R., as a clerk to the Purchasing Agent. He was made Purchasing Agent and Assistant Superintendent of the road, and was eventually advanced to the post of Superintendent. In this position he remained until May, 1881, when he was invited to go to St. Paul as Assistant General Manager of the St. Paul, Minneapolis & Manitoba Ry., and in 1887 he was elected First Vice-President and Manager of the road, in which position he remained until 1889, when he accepted the position of President of the Atchison, Topeka & Santa Fe R. R.

Mr. Isaac Collins Chesbrough, one of the last of the original engineers of the Baltimore & Ohio Railway, died at his home at Copake Iron Works, N. Y., on Jan. 23, 1893. Mr. Chesbrough was born in Baltimore, Md., Dec. 14, 1814, and began his engineering life as a rodman under Maj. George W. Whistler, Resident Engineer of the first mile of the B. & O. Railway. At the opening of the line, the first car was propelled by one

of his father's horses, and Mr. Chesbrough used to say he was "the first way-passenger on the Baltimore & Ohio system," as he was taken aboard at the first stop. He continued with this road until 1830, and then went with Major Whistler to the Baltimore & Susquehanna, now the Northern Central Railway. He remained there until 1833, during which period 12 miles of the main line and the branch to Owens Mills were constructed. Then, still with Major Whistler, he was employed on the Canton Viaduct section of the Boston & Providence R. R., and his ability and excellent judgment caused the President of that line, Mr. Thomas B. Wales, to select him as Locating Engineer for the Western R. R., of which Mr. Wales was later President. After locating a few miles near Worcester, he met with a serious injury, and was compelled to exchange office for field work. In 1838 he was appointed Resident Chief Engineer, and made the final location of the road west of Springfield to the New York line, and had charge of its construction.

After the completion of this work, the family met with financial reverses, owing to the collapse of the Erie railway, both he and his brother, E. S. Chesbrough, the late well known hydraulic engineer, being involved in the losses of their father, who was a prominent railway contractor of that day. For two years they gave up their professional work and tried farming in Niagara Co., N. Y. In 1844, however, Mr. I. C. Chesbrough became Chief Engineer of the Vermont Central R. R., and left this in 1847 to become Chief Engineer of the Sullivan, N. H., Railway. Early in 1850 he settled at the Copake Iron Works, N. Y., as a member of the Copake Iron Works Co., and gave up other professional work until 1859. Subsequently he was engaged on many important works, as chief engineer or as assistant to his brother, Mr. E. S. Chesbrough. These works included sewerage, tunnel and water-works, at Chicago, New Haven, Detroit, etc. From 1873 to 1877 he had charge of the construction of the Albany water-works. His last important work was the location of 66 miles of the Northern Pacific Railway across the Rocky Mountains, in 1881-83. He retired from active practice in 1890, having for some time previously been engaged in caring for large land interests of his cousins in Michigan. He married, in 1838, Harriet, the fifth daughter of Mr. Lemuel Pomeroy, a prominent manufacturer, to whom Pittsfield was largely indebted for railways and other improvements. His wife died in 1875, and but one of his three children survive him.

NEW PUBLICATIONS.

SEWAGE TREATMENT AND SLUDGE DISPOSAL. By W. Santo Crimp, M. Inst. C. E., F. R. M. S., etc. Pamph., pp. 26. London: R. J. Bush, "Engineering Record" Office.

A full abstract of this excellent discussion of the subjects named in the above title is given elsewhere in this issue.

TRADE PUBLICATIONS.

UNITED STATES WIND ENGINE AND PUMP CO.—Batavia, Ill. 8vo, cloth; pp. 216.

Besides a large line of pumps, plumbers' supplies and agricultural machinery, this company makes a specialty of windmills, and offers three patterns. One, we are pleased to notice, is an all steel mill, each vane made from a single piece of sheet steel pressed to the proper shape. This mill is furnished with graphite bearings, which require no oiling, and a steel tower is also furnished when desired. The list price of the steel mill is about the same as that of the wooden mills, and its added durability ought apparently to make it very popular.

SOCIETY PROCEEDINGS.

AMERICAN INSTITUTE OF MINING ENGINEERS.—The annual meeting was held at Montreal, Que., Canada, Feb. 21-25, at the same time as the meetings of the General Mining Association of Quebec, the Provincial Mining Association of Ontario, the Mining Society of Nova Scotia and the Asbestos Club, forming the International Mining Convention. The headquarters were at the Windsor Hotel, and the sessions were held in the rooms of the new Physics Building, of McGill University, which was kindly tendered for the use of the societies by the governors of the university.

The first meeting of the Institute was held in Windsor Hall, on the evening of Feb. 21, Hon. George Irvine in the chair. An address of welcome was delivered by Mr. Desjardins, mayor of Montreal. Mr. John Birkinbine, president of the Institute, read an interesting paper on "The Development of Technical Societies," an abstract of which we shall give later, in which he showed the important results which have attended the formation of such societies. Dr. Raymond, secretary of the Institute, acknowledge the address of welcome, and made a passing reference to annexation, by saying that as he did not find it necessary to propose to every lady he admired, so the United States might admire Canada without desiring to annex that country. Dancing occupied the remainder of the evening.

At the morning meeting of Feb. 22, Dr. Raymond, the Secretary, read the report of the Council. The membership has had a net increase of 154 during the year, and the total is now 2,376, as follows:

Honorary members	15
Foreign members	38
Members	2,136
Associates	187
Total	2,376

The total receipts were $26,595, and disbursements $23,131, leaving a balance of $3,483. The Council, for the Institute, has accepted the charge of the two divisions of Mining and Metallurgy of the International Engineering Congress, which will be held the first week in August, at Chicago, and these will constitute regular meetings of the Institute.

The first paper presented was by Major Powell, on the "Geological Survey of the United States," which was read by Mr. Hayes. For a geological map there must be; 1, A base map on which to represent the rock formations; 2, a systematic classification of the formations; and, 3, a system of conventions for representing these formations on the map. One of the first things to be done was to arrive at a systematic classification of rocks, and scheme of representing them. The system aodpted by the Geological Survey was described, with notes on the classification. Sections are of most value if printed on the body of the map instead of in the margin; but as this would complicate the colors and symbols, special sheets of sections, topography, surface deposits, etc., are issued. The maps are mainly on a scale of 1 inch to the mile, and are published as atlas sheets. About 12,000 square miles have been covered. The total cost, including engineering, is given as $4 per sq. mile for the topographic survey, and $7 to $8 per sq. mile for the geologic survey. Professor Selwyn, Director of the Canadian Geological Survey, referred to the work and systems in Great Britain and Canada, the latter being hampered by the very small amount of money available, only $60,000, as compared with $300,000 in the United States. It would be absurd, he thought, to attempt to imitate on maps the color of the rock formations, but he thought it desirable to have some more uniform representation. He also believed in the use of lines and letters as well as colors. Dr. Raymond agreed with Professor Selwyn as to the desirability of a uniform system of representation, and he did not want the United States standing out obstinately for its own system. Dr. Day, of the U. S. Geological Survey, said the matter in hand had to be published, and they tried to use the best system available.

A paper on "The Greene-Wahl Process for Manufacturing Manganese and Alloys of Manganese Free from Carbon" was then read by Mr. F. Lynwood Garrison. Samples were exhibited having an average composition of 96.5 manganese, 2 iron and 1.5 silicon, the metal being dense and homogeneous, with a steel-gray color and reddish-bronze tint. It has a pungent odor, attributed to hydrogen-silicide, has no tendency to oxidize and disintegrate in moist air, as does manganese containing considerable carbon, and it has an average specific gravity of 7.32. In the discourse, reference was made to an electric smelting furnace, and Dr. Raymond stated that the minimum cost of production of aluminum by any process now known would probably be 18 to 20 cts. He did not think the adoption of water power would reduce this, as where coal is cheap the steam engine is still the cheapest form of power.

Prof. W. B. Blake then read abstracts of three papers, dealing with lead and zinc ores: "The Mineral Deposits of Southwest Wisconsin," "Separation of Blende from Pyrites," and "A New Form of Furnace for Roasting and Oxidizing Ores." The furnace is a revolving table formed of a series of circular terraces, and is charged from the top, while the fire passes across the chamber. The ore is moved from step to step by means of "plows" set in the roof of the chamber, and by this method the ore is thoroughly subjected to the heat, and is nearer the fire just before its discharge. Superheated air is used in the furnace, and the table makes about ten revolutions per hour.

At the afternoon meeting Mr. R. H. Richards read a paper on "The Prismatic Stadia Telescope," being a continuation of a former paper, and giving details of the rods and targets, and also of a self-spacing target. Mr. A. J. Rossi then read an abstract of a paper on "Titaniferous Ores in the Blast Furnace." These ores are generally low in phosphorus and sulphur, and many are very rich in iron, even when high in titanic acid. Particulars were given of numerous tests, showing that good pig iron can be successfully made, and that this ore may become more generally available. Mr. Harrington said that experiments had been made with Canadian ore containing 48% titanic acid, but the results had not been successful. Dr. Egleston said that in testing an ore for phosphorus he had found 7% of titanic acid, but no phosphorus, and some furnaces may be using titanic ores without knowing it. Another member stated that titaniferous ores are successfully worked in Sweden.

A paper on "The Biwabik Iron Mine," by H. V. Winchell and J. T. Jones, was read by Mr. Winchell. This is one of the newest mines of the Mesaba Range, and while no ore has yet been shipped a considerable amount of money has been spent in thorough exploration. The working will be by stripping and open pit mining. There will be about 2,800,000 cu. yds. of glacial drift removed to prepare the deposit for working, and the deposits are about half a mile wide and 100 ft. thick in places. The grades of the steam shovel tracks will be 1½%. The ore is soft, and averages 63.25% metallic iron and .036 phosphorus. The steam shovels will dig the ore and load directly onto the cars. The stripping will be dumped by side dump cars. Dr. Raymond said that the topographic and other conditions are so good that probably the cost will be only about 16 cts. per ton for stripping, mining and loading. Mr. Birkinbine referred to the recent and rapid developments of these Minnesota iron deposits, and stated that the men who developed the Vermilion Range, passed over the Mesaba Range, which is now being developed (Eng. News, Jan. 19).

At the morning meeting on Thursday, Feb. 23, Mr. R. H. Richards read a paper on "A Graphical Slag Calculation." This was followed by a paper on "Unfreezable Dynamite," by Mr. E. E. Russell Tratman, an abstract of which we publish elsewhere. The paper called attention to the introduction of an unfreezable dynamite, and in the discussion several methods of thawing frozen dynamite were mentioned, but it was pointed out by Dr. Raymond that all precautions for insuring safety in thawing may be set at naught by an ignorant or careless laborer who is in a hurry to get some cartridges ready for immediate use. The subject was discussed by several members, and we have added notes on the discussion to our abstract of the paper. The secretary then read a paper by Mr. B. J. Lawrence on "The Lease or Tribute System, as Practiced in Colorado." By this system a miner leases from the mine owners a certain block of ground in the mine, forming an extension of a drift, for, say, 100 ft., and drives this at his own expense, the owner furnishing powder, fuse and candles, and the lessee pays for these, for hoisting the ore and dirt, and all other expenses incident to the handling of the ore. The lessee has to drive the level 100 ft. and pay to the owner a royalty of 25 to 33⅓%, according to what the surrounding ground has yielded. There was some discussion on this paper, and Dr. Raymond showed how the lease system obviated many of the difficulties which exist between owners and men when the latter are paid by the day and are not directly interested in the output. As subletting is not allowed the sweating system cannot be developed from this system. A paper on "The Use of Producer Gas for Drying and Roasting Ore at the Lixiviation Mill of the Holden Smelting & Milling Co., Aspen, Col.," by W. S. Moyse, was then read by the secretary, and the following papers were read by title:

"Note on Anthracite Coal-Apples from Pennsylvania," by W. S. Gresley; "The Reduction Works of the Mount Stewart Lead & Silver Mining Co., Leadville, New South Wales," F. M. Drake; "The Mineral Resources of Southeastern Alaska," G. W. Garside; "The Cause of Faulting," John A. Church; "A Variable Speed Pulley," H. C. Spaulding; "The Big Gap Coal Fields," James M. Hodge; "An Investigation of Coals for Making Coke in the Semet-Solway Ovens, with the Recovery of Ammonia and Tar, and Remarks on the Commercial Sources of Ammonia," J. D. Pennock; "Notes on Emmerton's Method for the Determination of Phosphorus," H. C. Babbitt; "Notes on the Geology of the Half Moon Mine, Pioche, Nev.," E. A. Wiltsee; "Method of Plumbing a Shaft," A. Neustaedter, and "The Phosphate Mines of Canada," Henry B. Small.

A resolution thanking the Canadian mining societies, the authorities of McGill University, and the local committees for their kindness and hospitality was passed. The president then read the report of the scrutineers of the ballot for officers for the ensuing year, the result of the election being as follows: President, Henry M. Howe, Boston, Mass.; Vice-Presidents (two years), A. J. Bowie, Jr., San Francisco, Cal.; Robert G. Leckie, Londonderry, N. S., and E. G Spilsbury, New York, N. Y.; Managers (three years); H. H. Campbell, Steelton, Pa.; W. L. Sheafer, Pottsville, Pa., and A. M. Shook, Tracy City, Tenn.; Treasurer, T. D. Rand, Philadelphia, Pa.; Secretary, Rossiter W. Raymond, New York, N. Y.

In the afternoon some of the members attended the meeting of the Canadian mining societies, while others drove in sleighs to the Park toboggan slide, and experienced the delights of the novel and exhilarating sport of sliding down hill at the speed of an express train. In the evening there was a joint session of the American and Canadian societies, Capt. R. C. Adams, of Montreal, in the chair. The following papers were read and discussed: "Hydraulic Mining in British Columbia," J. McEvoy; "Apatite Mining in Quebec," J. Burley-Smith, and "The Electrolytic Extraction of Metals from their Ores," W. T. Gibbs. Captain Adams then read a brief paper, "Notes on a Recent Visit to West Kootenay, B. C.," giving some particulars of the Kootenay

mineral region, which, he thought, will be the great silver producing district of the world. Most of the people and the greater part of the machinery and supplies are from the United States, and he expressed strong disapproval of the United States duty on imported ore, the Canadian duty on machinery, and the Canadian law that home-made supplies must be conveyed through Canadian territory. If the Dominion government does not release the present stringent regulation he thought British Columbia might look for annexation to the United States as a relief.

On Friday, Feb. 24, a large number of members attended the ceremonies at the opening of the new McDonald Engineering Building, McGill University. The building is a large and handsome structure, well equipped with the best and most modern machinery and appliances, and has cost nearly $1,000,000, including equipment. It is the gift of Mr. W. C. McDonald, and the city has also contributed to the expense. Addresses were made by Sir Donald Smith, Lord Stanley, Governor-General of Canada; Mr. Birkinbine and Dr. Raymond, of the American Institute of Mining Engineers; Mr. Charles Macdonald, Vice-President of the American Society of Civil Engineers; Mr. E. P. Hannaford, Chief Engineer of the Grand Trunk Ry.; Dr. Grant, of Kingston College; Sir Casimir Gzowski and Mr. T. C. Keefer, of the Canadian Society of Civil Engineers, and Professor Bovey, Dean of the Faculty and Professor of Applied Science. Mr. W. C. McDonald, the founder of the building, presented to the Governor-General the keys of the building, but made no speech. In the afternoon they also attended the opening of the Workman Physics Building, the first bequest for which was given by the late Mr. Thomas Workman. Addresses were made by Professor Cox, who is at the head of this department; Professor Barker, of Philadelphia University; Lord Stanley, Governor-General; Chancellor Heneker, of Bishop's College, and Dr. Egleston, of the Columbia School of Mines, New York. Other members joined the afternoon excursion of the Canadian Society of Civil Engineers, visiting the Victoria tubular bridge (Grand Trunk Ry.) and the Lachine cantilever bridge (Canadian Pacific Ry.), both crossing the St. Lawrence River; and also walked through the shops of the Dominion Bridge Co. In the evening there was a large attendance of members at a conversazione in the McDonald Engineering Building, given by the Governors of McGill University in honor of the official opening of the engineering and physics buildings, while others atttended a fancy dress skating carnival in the Victoria Rink.

On Saturday, Feb. 25, a special train carried a large party over the Quebec Division of the Canadian Pacific Ry. to the Radnor Forges of the Canada Iron Furnace Co., where charcoal pig iron is manufactured. The works are among the oldest on the continent, iron having been made there in the sixteenth century. The engine room, blast furnace, casting house and charcoal ovens were visited, and then the party assembled in the church, where a few addresses were made. The train then proceeded north to Grand Piles, stopping at Lake la Tortue, where bog ore is dredged. At Grand Piles a number of lumber sleighs fitted with seats were in readiness, and the whole party was taken for a most interesting and beautiful drive across the St. Maurice River and through the woods. Leaving Grand Piles about 5 p. m. the train reached Montreal at 10 p. m., and several of the members hastened to the hotel and then went to the reception at the residence of Sir Donald Smith. This was the final event of a most enjoyable visit and meeting, made specially so by the hospitality of the Canadian hosts and by their care for the comfort and pleasure of the visitors.

GENERAL MINING ASSOCIATION OF QUEBEC.—At the meeting in Montreal, Feb. 22, the following officers were elected, the president, secretary and treasurer being re-elected: President, George Irvine; Vice-Presidents, Capt. R. C. Adams, John Blue, Jas. King and R. D. Hopper; Secretary, B. T. A. Bell; Treasurer, A. W. Stevenson. Mr. Bell, in his report, stated that during the year the association had secured the abolition of the mining tax in Quebec, and had now half accomplished the abolition of the gunpowder tax.

On Feb. 23, at a joint meeting with the other societies, being a meeting of the International Mining Convention, Capt. R. C. Adams in the chair. Mr. A. Blue, Director of Mines of Ontario, read a paper on "Notes on the Mining Law of Ontario," and Mr. H. S. Poole followed with one entitled "Notes on the Legislation Affecting the Working and Regulation of Mines in Nova Scotia," both of which gave rise to considerable discussion on vexed questions of mining laws. A paper entitled "Notes on the Drummond Colliery." was then read by the secretary, Mr. Bell, and gave particulars of the working of the mine and the extinguishing of a recent fire therein. Dr. R. W. Ells, of the Canadian Geological Survey, then read a paper on "The Apatite Deposits of the Ottawa District," being one of several papers on the phosphate resources. At the joint meeting of the convention in the evening, Mr. J. McEvoy read a paper on "Hydraulic Mining in British Columbia," arguing against this method of mining because of its injury to arable land by the debris. Dr. Raymond (Am. Inst. Min. Engrs.) discussed the paper from the opposite point of view, and gave a description of the system and its results in California, where, as he showed, the production of gold had been materially reduced by legislation adverse to hydraulic mining. Capt. J. Burley-Smith then read a paper on "Apatite Mining in Quebec," in which he said that there is no prospect of a rise in prices, and that therefore miners must try to introduce better and more economical methods of working to meet the present low prices. A paper on "The Electrolytic Extraction of Metals from Their Ores," by W. T. Gibbs, was then read by Mr. S. P. Franchot, and Captain Adams read some "Notes on a Recent Visit to West Kootenay, B. C.," as mentioned in the previous report of the meeting of the American Institute of Mining Engineers. At the morning meeting on Feb. 24 the following resolutions were passed:

That there is a necessity for the enlarged and more secure housing of the collection of the Geological and Natural History Survey of Canada.

That it would be in the interests of mineral and metallurgical development were a compilation made of all information relating thereto from the time of Sir William Logan's summary of reports in 1863 up to the census year 1890; also that it would be desirable were the report of the Geological Survey divided into two volumes, one of which should treat on the geological work of the survey, and the other on all matters relating to mineral occurrences, mining and metallurgy; also, that the prices of the Geological Survey publications should be reduced to somewhat the same scale as that charged by the Geological Survey of the United States.

That it would be in the best interest of the country were the present bonus on iron continued by the Dominion government, and were the question of provincial bonuses considered favorably by the different provincial governments; also were the question of the manufacture of steel rails and of nickel-steel in Canada favorably considered by the Dominion and the provincial governments.

The following papers were presented by title: "Modification of Working Coal Lately Introduced in Nova Scotia," several papers by members of the Mining Society of Nova Scotia; "Notes on the Mineral Resources of New Brunswick," W. McInnes; "The Gypsum Deposits of Nova Scotia," Dr. E. Gilpin; "The Future of Mining in the Province of Quebec," J. Obalski, M. E., Inspector of Mines, Quebec; "The Bog Iron Ores and Ochres of Champlain County, Que.," A. P. Low; "The Composition of the Bog and Lake Ores Used at Radnor Forges (Que.), and of the Iron Produced Therefrom," J. T. Donald; "The Manufacture of Charcoal Iron from the Bog and Lake Ores of the Three Rivers District, Que.," P. H. Griffin; "Notes on the Gold Fields of the Chaudiere District, Que.," L. Gendreau; "Canadian Micas and Their Development," Prof. B. J. Harrington; "Notes on the Mineral Resources and Industries of Thunder Bay, Ont.," W. W. Russell; "The Iron Ores of Frontenac and Leeds, Ont.," J. Bawden; "The Development of Some Ontario Iron Ores," T. D. Ledyard; "Notes on the Coal Fields of Canada, and the Systems of Working Them," W. Hamilton Merritt; "Notes on that Portion of the Mining Law of Nova Scotia Relating to Gold," G. W. Stuart, J. E. Hardman and B. C. Wilson; "Notes on that Portion of the Mining Law of Nova Scotia Relating to Mines Other than Gold," C. Archibald and J. R. Lithgow; "Notes on the Mines Regulation Chapter (Nova Scotia)," R. G. Leckie, R. H. Brown and H. S. Poole.

PROVINCIAL MINING ASSOCIATION OF ONTARIO.—At a meeting at Sudbury, Ont., on Feb. 17 the following resolutions were carried:

That royalties on minerals be abolished; that the blanket application be abolished; that all applications for mining lands should be made to the local Crown lands' agent, and under the same regulations as those of British Columbia; that the price of mineral lands in Ontario belonging to both the province of Ontario and Dominion of Canada be reduced to a uniform price $2 per acre; that liberal land grants similar to those made by the Dominion government and the state of Michigan should be made for the building, not only of highways, but railways throughout the unsettled portions of the province; that reciprocity between Canada and the United States in all minerals and the manufactured product thereof would be beneficial to the mining interests of Canada; that the Dominion government admit free of duty all machinery, cokes, explosives and other requisites for mining; that two delegates be sent to the Montreal Convention to represent the Association.

George Mickle, Second Vice-President, and John W. McKay, Secretary, were appointed a delegation on behalf of the Association to attend the International Mining Convention at Montreal.

MINING SOCIETY OF NOVA SCOTIA.—At the meeting in Montreal on Feb. 22, Mr. H. S. Poole, president, in the chair, a paper was read by Mr. E. Sjostedt, on "Notes on the Ores and Plant of the Picton Charcoal Iron Co., at Bridgeville, N. S.," and Mr. James T. Burchall followed with a paper on "Electrical Coal Cutting." The coal mining of the future, he said, will be done by machinery, and so it was necessary to study the most economical method and the power to drive the machinery. He described the different styles used, and said that the question of the cheapness of compressed air and electricity was debatable ground, but he discussed the two methods, and gave the verdict to the latter, because the power could be carried longer distances with less loss, and the connections could be more easily made. It could be used for more varieties of work in cutting, hauling, pumping and lighting. He gave an account of his success in adopting an electric plant which had saved 30% of the cost. There was no more danger of flashes from the brush than in the use of naked lamps, which were freely used in Nova Scotia.

The society also took part in the joint meetings of the International Mining Convention.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—At the meeting on Feb. 23 the following officers were elected: President, E. P. Hannaford; Vice-Presidents, Thomas Munro, P. A. Peterson and W. J. Jennings; Secretary, C. H. McLeod; Treasurer, Herbert Wallis. Mr. John Kennedy, the retiring president, delivered an address. A paper by Mr. Torrance, on "Gold and Silver Mining in Quebec," was presented. At the evening meeting Prof. J. T. Nicholson read a paper on, "Transmission and Distribution of Power by Compressed Air," pointing out the advantages of this system of power transmission, and its use for street railways, etc. On Friday afternoon, Feb. 24, there was an excursion to the Victoria and Lachine bridges across the St. Lawrence.

NORTHWEST RAILROAD CLUB.—At the meeting on Feb. 14 Mr. John Hickey, Supt. of Motive Power of the Northern Pacific, read a paper on "Boiler Inspection." He advised that in testing the strength of a boiler a hydraulic test be first made, followed by a steam test. The test pressure should be not over 40% in excess of the working pressure, and should be maintained for half an hour or longer, during which time the boiler should be carefully measured to locate any distortions which may occur. The pressure at which the test is made should be measured by at least two independent gages.

ENGINEERS' CLUB OF PHILADELPHIA.—At the meeting on Feb. 18, Mr. S. M. Vauclain read a paper on, "The Baldwin Four-Cylinder Compound Locomotive," illustrated by lantern slides and a model working under steam. Descriptions were given of the various types of two, three and four-cylinder compound locomotive engines; also statistics of the production and rates of economy of the Baldwin engine.

COMING TECHNICAL MEETINGS.

ENGINEERS' CLUB OF PHILADELPHIA.
March 4. 1122 Girard St. Secy., L. F. Rondinella.

MONTANA SOCIETY OF CIVIL ENGINEERS.
March 4. Secy., F. D. Jones, Helena.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
March 6. Secy., C. L. Annan, City Engineer's Office.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
March 7. Secy., Chas. S. Howe, Case School.

ENGINEERS' SOCIETY OF PHŒNIXVILLE.
March 7. Secy., W. Halliburton.

CIVIL ENGINEERS' ASSOCIATION OF KANSAS.
March 8. Wichita, Kan.

NEW ENGLAND RAILROAD CLUB.
March 8. "Air Brakes on Locomotive Truck Wheels." Secy., F. M. Curtis, O. C. R. R., Boston.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
March 9. Secy., F. W. Mowbray, Norton Building.

ENGINEERING ASSOCIATION OF THE SOUTH.
March 9. Secy., O. H. Landreth, Nashville, Tenn.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
March 10. Secy., D. W. Meeker, St. Paul.

WISCONSIN POLYTECHNIC SOCIETY.
March 13. Secy., M. F. Schinke, City Hall.

ENGINEERS' CLUB OF KANSAS CITY.
March 13. Secy., Waterman Stone, Baird Building.

ATLANTA SOCIETY OF CIVIL ENGINEERS.
March 14. S. W. Spear, E. Buffalo, N. Y., Iron Works.

NORTHWESTERN SOCIETY OF ENGINEERS.
March 14. Secy., D. W. McMorris, Burke Block, Seattle, Wash.

NORTHWEST RAILROAD CLUB.
March 14. Ryan Hotel, St. Paul. Secy., W. D. Crosman.

DENVER SOCIETY OF CIVIL ENGINEERS.
March 14. Secy., F. E. King, Jacobson Block.

BOSTON SOCIETY OF CIVIL ENGINEERS.
March 15. Secy., S. E. Tinkham, 36 Broomfield St.

ENGINEERS' CLUB OF ST. LOUIS.
March 15. Secy., Arthur Thacher, Odd Fellows' Building.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
March 15. Secy., F. Collingwood, 127 East 23d St., New York.

ASSOCIATION OF ENGINEERS OF VIRGINIA.
March 15. Annual meeting. Secy., J. E. Schick, Roanoke, Va.

NEW YORK RAILROAD CLUB.
March 16. Secy., H. G. Prout, 73 Broadway, N. Y.

ENGINEERS' CLUB OF CINCINNATI.
March 16. Secy., J. F. Wilson, 24 W. 4th St.

SCANDINAVIAN ENGINEERING SOCIETY OF CHICAGO.
March 16. Secy., C. F. Franson, Portland Block.

TACOMA SOCIETY OF ENGINEERS AND ARCHITECTS.
March 17. 201 Washington Building.

SWEDISH ENGINEERS' CLUB.
March 18. Secy., P. Valentine, At 231 Union St., Brooklyn, and 646 North 10th St., Philadelphia. At 180 La Salle St., Chicago. Secy., John Ericson.

COLUMBIAN ENGINEERING SOCIETY.
March 21. Secy., F. W. Hart, Washington, D. C.

WESTERN RAILWAY CLUB.
March 21. Secy., C. F. Street, Rookery Building, Chicago.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
March 21. Secy., E. H. Clark, Pittsburg.

CENTRAL RAILWAY CLUB.
March 22. Secy., S. W. Spear, Buffalo, N. Y.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
March 24. Secy., C. H. McLeod, Montreal, P. Q.

WESTERN SOCIETY OF ENGINEERS.
April 5. Secy., Jno. W. Weston, 51 Lakeside Bldg., Chicago.

ENGINEERS' CLUB OF MINNEAPOLIS.
April 6. Secy., E. Nexsen, 504 Kasota Block.

ASSOCIATION OF CIVIL ENGINEERS OF DALLAS.
April 7. Secy., E. K. Smoot, 808 Commerce St.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
April 7. Secy., O. Von Geldern, 719 Market St., San Francisco.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
April 20. Atlanta, Ga. Secy., F. A. Charpiot, Macon, Ga.

ENGINEERING NEWS

AND

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ADVERTISING RATES: 20 cents per line agate measure. Schedule sent on request. Changes of advertisements must be in hand on Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements, not later than Wednesday noon. The last pages go to press early on Thursday. We shall be obliged if subscribers who fail to receive their papers promptly will notify us without delay.

By an accident in the "make-up" the two halves of the special train for the Emperor of Austria, on pages 170, 171 of our issue of Feb. 23, were transposed, so that the second half should have been first, and vice versa.

A bill making compulsory the equipment of freight cars with automatic couplers and continuous brakes passed Congress on Feb. 27, and will doubtless receive President Harrison's signature. We have repeatedly pointed out that whether or not a national law on this subject was advisable, the probabilities were that it would be enacted, and that the railway companies would be wise to use their influence in shaping such legislation so as to secure the greatest benefits and least injuries, instead of spending their energies fighting the inevitable. We believe it is due to the advice of several prominent railway officers, which has been sought by some of those who have been prominent in pushing the bill before Congress, that it has been finally passed in the present form, and that unwise and Quixotic features which have from time to time been incorporated in bills of this character before Congress have been struck out. We reprint the full text of the bill in another column. In substance its requirements are that by Jan. 1, 1898, all freight cars must be equipped with automatic couplers, and a sufficient proportion must be equipped with power brakes to do away entirely with hand braking. By the same date all locomotive engines must have both driving wheel brakes and appliances for operating the train brakes. Less important provisions are that by July 1, 1895, all cars must be equipped with grab-irons on the ends and sides and must have drawbars of a uniform standard height, to be determined by the American Railway Association and announced within 90 days. Four-wheel cars are exempted from the provisions of the act, and the Interstate Commerce Commission is given power to extend the period within which any common carrier shall comply with the provisions of the act. The penalty for any violation of the act is $100, and employees do not lose their right to sue for damages in case of injury by continuing in the service of a company which does not observe the law.

It will be noticed that the bill, as passed, makes no provision as to what brakes or couplers shall be used. That is wisely left for the railways themselves to determine, and in such manner as they see fit. We are aware that many of the railway officers who deserve greatest praise for their works in furthering these reforms have opposed legislation on the ground that the poorer railway companies would comply with the letter of the law by purchasing the cheapest brakes and the cheapest couplers, and that the proper standards for both brakes and couplers were still so uncertain that the best course was to "make haste slowly." This difficulty must now be faced; and wise action by the representatives of the various railway companies in the American Railway Association and the Master Car Builders' Association is urgently needed to secure the greatest measure of good and the least of evil from the brake and coupler law.

Congress has gone as far as it can well go in compelling uniformity; it remains for the railways to do the rest. One duty, that of determining the uniform drawbar height, is expressly laid on the American Railway Association, and it may well be asked why a stop should be made there, and why an absolute uniformity of couplers, unlocking gear, dead-blocks and grab-irons should not be decided upon and enforced through the interchange rules. That uniformity is needed in the interests of economy, as well as of safety, is generally conceded. The sooner it is decided upon the better; for the date when the reforms named in the law must be completed leaves little time for inaction.

Prices obtained for armor plates by the Carnegie and Bethlehem steel companies, who are the only manufacturers in the country, may well excite the envy of steel makers who hunt for customers for best structural steel at prices under $40 per ton. Bids were opened on Feb. 5 at the Navy Department for about 7,000 tons of nickel-steel armor plate. The prices bid by the two firms ranged from $520 to $885 per ton, for the different sizes and kinds of plates specified. About $56 per ton extra is asked for treating the plates by the Harvey process. Making a very liberal estimate of the cost of manufacture, it looks as if the profits on this order alone ought to go a long way toward repaying both the companies for their original expenditure on their armor-making plant. It is of interest to notice also that at an average price of $600 per ton the armor for the new line battleship "Massachusetts" will cost about $1,225,000; the total cost of the vessel was estimated at $3,020,000.

Later and more detailed announcements of Civil Engineer R. E. Peary's plans for his Arctic expedition show that he will probably winter this year but little north of "Redcliff," his old headquarters, reaching camp toward the end of July, and spending the remainder of the season in local explorations, and establishing a large cache in the interior. He will then start northward early in March, instead of May 15, and will make the experiment of using donkeys and ponies shod with rough snow-shoes to supplement his dog trains, as is done in Norway. With four or five men besides himself he will push for Independence Bay, his former terminal, and there split his party into two, one of which will push southeasterly along the hitherto unexplored east coast of Greenland, as far as to Cape Bismarck, and thence return back across Greenland to camp.

In the meantime Peary himself, with only one or two companions, will push north from Independence Bay "to determine the nature and extent of the archipelago which has been found to lie north of Greenland." His plans thereafter are necessarily vague and unforeseeable, except that he looks forward to considerable trouble in getting about among these islands, and does not expect that the eternal ice fields of Greenland will be duplicated on any part of the islands immediately to the north of it. All his expectations are limited to discovering more about these islands than has hitherto been known. So much he expects to achieve. The total cost of the expedition is estimated at $20,000 to $25,000, which Mr. Peary is earning by lectures. He sails for Europe early in May to deliver some addresses there, accompanied by Mrs. Peary.

THE TRACKLAYING OF 1892 AND PROSPECTIVE RAILWAY CONSTRUCTION OF 1893.

We present with this issue the first of our general reviews of the status of railway construction in the United States in 1893. As explained elsewhere, these general reviews of the whole country will take the place, for the present year at least, of the more detailed maps of the various sections of the country which we have heretofore published at regular intervals. On this account we have been at unusual pains to make our list of lines upon which there is a probability of work being resumed, or begun, this year, reliable, and to weed out as far as possible all lines which, from present indications seem to afford little or no prospects for work. Nearly all the lines in the detailed list given elsewhere have been officially reported to us, and making allowances for the sanguine natures of railway projectors, and remembering that

"The best laid schemes o' mice and men
Gang aft a-gley;"

we believe the list to furnish the most reliable information published on the distribution and prospects of railway construction in this country for the current year.

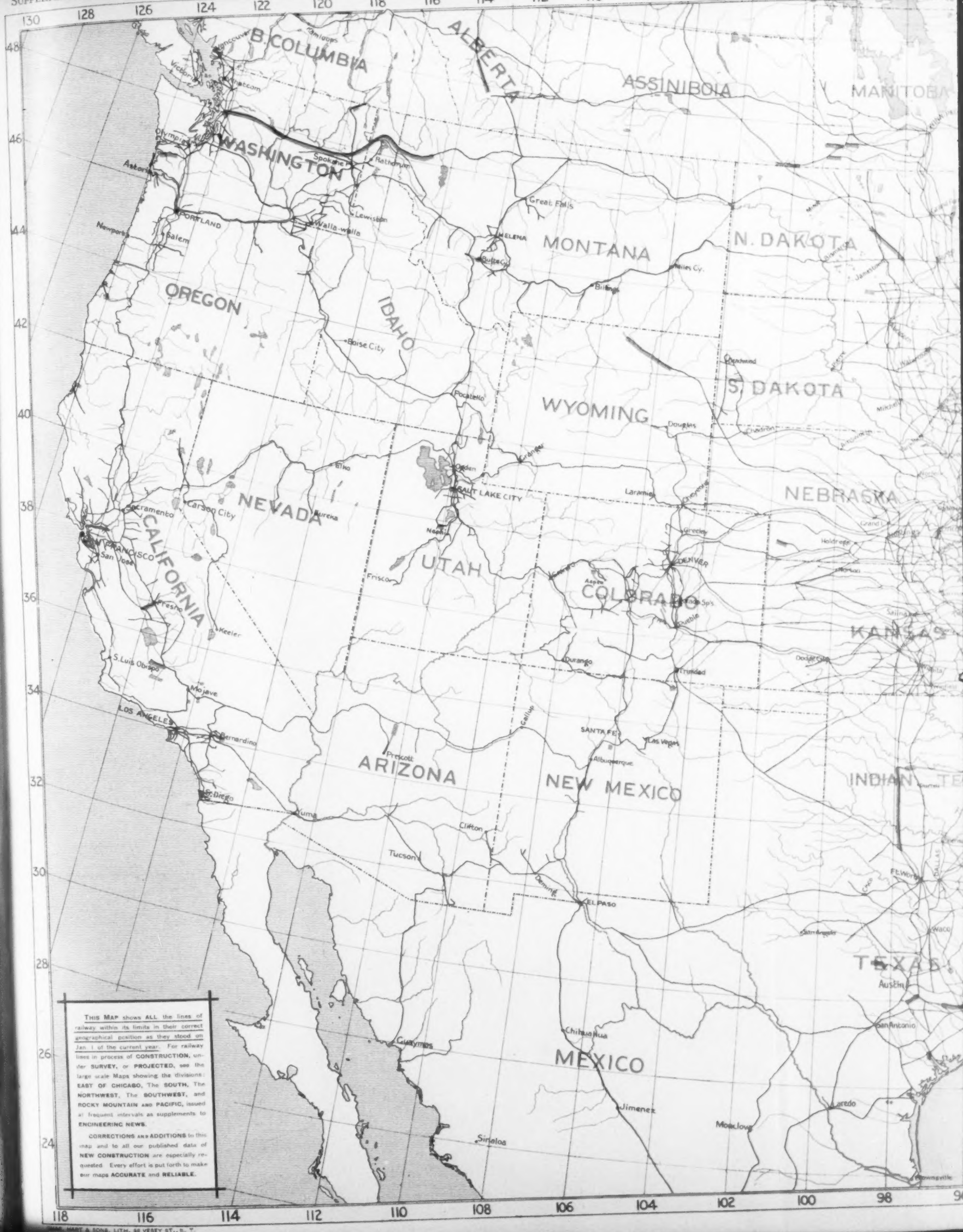
According to the summary of our detailed list, the mileage of new railway built in 1892 is 4,070 miles, and there are now 3,069 miles of railway partly completed or under contract, 2,458 miles upon which surveys have been completed or are in progress, and 431 miles which have not been surveyed, but which have a prospect of being placed under construction or contract in 1893. Of course it is to be understood that these figures do not include all lines upon which surveying has been done or which are projected for future construction, but merely such as seem likely to do some actual work this year. Comparing these totals with those published a year ago, we have the following results at the dates named:

	Track laid previous year.	In process of construction.	Surveyed or under survey.	Projects of some promise.
March 5, 1892...	4,471	4,274	4,630	1,520
" 2, 1893...	4,069	3,069	2,458	431
Decrease miles...	402	1,205	2,172	1,089
" per cent..	8.99	28.2	46.9	71.7

These figures, it will be seen, show a decided decrease in the activity of railway construction. For several reasons, however, they should not lead to too dismal views as to the prospects for the year. As before noted, especial pains have been taken to reject all in any degree doubtful enterprises from our figures; that is, the list for 1893 has been compiled on a more conservative basis than that for the previous year. This fact alone will account for a considerable percentage of the decrease, especially in the lines surveyed and projected. Yet the fact is that the present year opens with less favorable prospects for the active construction of new lines than did the year of 1892. The crops of 1892 were poor compared with those of 1891; railway earnings have, on the whole, been decidedly poor in the South, which has been the theater of the greatest activity in railway construction for the past few years until 1892; the several long extensions by the larger systems which contributed largely to the mileage of new railway in 1891 and 1892 are nearly all completed; and last, the great increase in business expected during the World's Columbian Exhibition and the extra demands made by this increase upon the resources of the larger companies tend to postpone the construction of new lines by them. Our present anticipations are that a less mileage of new railway will be built in 1893 than there was in 1892.

Considering the various enterprises mentioned in our list somewhat in detail, we present in Table I. the comparative mileages of new track laid in each state and group of states in the years of 1891 and 1892.

It will be seen at once that the greatest decrease in new construction has been in the South Atlantic and South Central states. Every other group, except the Pacific, where the decrease is merely nominal, shows an increase in the mileage of railway built in 1892 over that built in 1891. For the separate states the figures are less regular, as might be expected. The group having the greatest



THIS MAP shows ALL the lines of railway within its limits in their correct geographical position as they stood on Jan. 1 of the current year. For railway lines in process of CONSTRUCTION, under SURVEY, or PROJECTED, see the large scale Maps showing the divisions: EAST OF CHICAGO, The SOUTH, The NORTHWEST, The SOUTHWEST, and ROCKY MOUNTAIN AND PACIFIC, issued at frequent intervals as supplements to ENGINEERING NEWS.

CORRECTIONS AND ADDITIONS to this map and to all our published data of NEW CONSTRUCTION are especially requested. Every effort is put forth to make our maps ACCURATE and RELIABLE.

HAR. HART & SONS, LITH. 32 VESEY ST., N. Y.

104 102 100 98 96 94 92 90 88 86 84 82 80 78 76
MANITOBA
WINNIPEG
N. DAKOTA
S. DAKOTA
MINNESOTA
ONTARIO
MICHIGAN
WISCONSIN
IOWA
NEBRASKA
ILLINOIS
KANSAS
MISSOURI
KENTUCKY
TENNESSEE
INDIAN TER.
ARKANSAS
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
TEXAS
LA
CHICAGO
ST. LOUIS
NEW ORLEANS
HOUSTON
DALLAS
Ft. Worth
San Antonio
Galveston
Austin
Laredo
Brownsville
150 MILES TO 1 INCH
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QUEBEC
MAINE
BOSTON
NEW YORK
PHILADELPHIA
VIRGINIA
CHARLESTON
ENGINEERING NEWS
SERIES OF MAPS: No. 47.
UNITED STATES.
TRACK LAID IN 1892.
LINES OF RAILWAY WHICH HAVE SOME PROSPECT OF BEING COMPLETED OR PLACED UNDER CONSTRUCTION OR CONTRACT BEFORE JAN. 1, 1894.
For details of progress on the various lines, with principal projectors or officers, see accompanying list.

mileage of new line to its credit in 1892 is the North Central, where 795 miles were built, and the state in which the greatest mileage was built in the same year is Washington, with 424.4 miles. After Washington come, in the order named, Pennsylvania, New York, Michigan, Ohio, Minnesota and West Virginia, with 272 miles, 251 miles, 231 miles, 213 miles, 200 miles and 195 miles, respectively. In three states, Vermont, Rhode Island and Nevada, no new track was laid, and in Connecticut and Delaware only a fraction of a mile. The state of Kansas, which laid 1,526 miles in 1886, 2,102 miles in 1887 and 508 miles in 1888, laid 1.4 miles in 1891 and 1 mile in 1892 and from the present outlook there is little prospect that a much greater amount will be laid in 1893.

Table I.—Showing by States and Groups of States, the Mileage of Railway Built in 1891 and 1892.

	Track laid. 1891.	1892.		Track laid 1891.	1892.
New England.			**South Central.**		
Me	5.	14.6	Ky	31.13	49.45
N. H	3.39	25 72	Tenn	224.51	67.08
Vt	19.	....	Ala	162.18	21.00
Mass	5.76	27.44	Miss	....	8.00
R. I	6.	....	La	153.58	80.25
Conn	....	0 62	Total	571.20	225.78
Total	39.15	68.28	**Southwestern.**		
Middle.			Mo	50.67	171.11
N. Y	170.	251.34	Ark	105.38	37.00
N. J	36.23	74 20	Kan	1.40	1.00
Pa	335.	271 85	Tex	130.98	216.29
Del	....	....	Colo	160.86	27.30
Md	3.	10.70	New Mex	35.40	6.75
Total	544.25	608.13	Ind. Ter	10.52	116 00
North Central.			Total	495.11	575.15
Ohio	262.75	212.82	**Northwestern.**		
Mich	152.69	231.24	Ia	39 70	70.5
Ind	33.41	150.72	Minn	113.38	199.71
Ill	93.45	78.01	Neb	23.21	52 80
Wis	171 73	111 75	S. Dak	89.51	13.50
Total	654 03	794.54	N. Dak	100.75	92.50
South Atlantic.			Wyo	47.80	105.00
Va	200.29	25.08	Mon	94.91	127.30
W Va	120.10	191.90	Total	506.35	661.31
N. C	105.98	48 10	**Pacific.**		
S. C	203.32	29.83	Cal	175.51	79.16
Ga	294.73	58.80	Ore	45.50	9.50
Fla	85.98	135.05	Wash	325 30	425.10
			Ariz	3.36	18.
Total	1,010.40	491.76	Utah	77.11	29 5
			Idaho	20.40	82 7
			Total	650.67	644.26

As during the past few years, a considerable proportion of the track laid in 1892 was on short branches and spurs of local importance only, in contradistinction to the long extension into new territory which characterized the construction of years of 1886-7-8. At the same time a greater number of long lines were built than in 1890 or 1891. The location and extent of these will be seen by examining the map and detailed list. By far the longest of these was the extension of the Pacific Extension of the Great Northern line to the Pacific coast, 556 miles, which has been under construction for the past three years. The completion of this extension gives another through line from the East to the Pacific Coast, lying about midway between the Canadian Pacific Ry. on the north and the Northern Pacific R. R. on the south. This line is naturally and geographically the most formidable competitor of the Northern Pacific R. R., and rumors are not lacking in regard to the probability of an immediate lively rate war between the two companies. These are so far, however, merely rumors, and it is to be hoped that the common sense of the managers of the two lines will prevent anything more substantial. Another line of considerable importance which is reaching out toward the same region is the extension of the Burlington & Missouri River R. R., 105 miles of which were completed in 1892. The prospects are that this line may soon be carried through to a connection with some of the railway lines in Montana, but no reliable information can be obtained of the company's intentions. In the Southwest, the Chicago, Rock Island & Pacific Ry. has added 128 miles to its extension south through Indian Territory and Texas, and has a still further extension to Ft. Worth, Tex., and probably the Gulf coast, in contemplation. Further east in Ohio and Indiana the Wabash Ry. has completed a 148-mile extension, giving it an independent line into Chicago, and in New York the Vanderbilt interests have completed a new road through the Adirondack lake region, and the Lehigh Valley Ry. has finished its new extension to Buffalo, N. Y. Among the other more noteworthy extensions completed in 1892 are: The Sandusky & Columbus Short Line, from Sandusky to Columbus, O., 95 miles of which were built last year, and the extensions of the Norfolk & Western R. R., in West Virginia, and the Jacksonville, St. Augustine & Indian River R. R., in Florida.

In addition to the statistics of railway construction in the United States, we have also collected figures of the new construction in Canada. While, owing to the difficulty in obtaining correct returns from the various companies, we claim no such correctness for these figures as for those covering the United States, they are substantially accurate. According to them, 295 miles of new railway were built in the Dominion of Canada in 1892. This brings the total mileage of railway in that country up to about 14,400 miles.

Turning now to the mileage of new railway which will probably be put under contract or construction in 1893, we present in Table 2 a summary of the mileages by states and groups of states.

Table II.—Showing by States and Groups of States the Mileage of Railways Under Construction and Survey, and Projected on March 2, 1892.

	In process of construction.	Surveyed or under survey.	Projected.		In process of construction.	Surveyed or under survey.	Projected.
New England.				**South Central.**			
Me	114	138	....	Ky	66	7	....
N. H	....	5	....	Tenn	49	148	....
Vt	....	29	....	Ala	63	106	....
Mass	....	13	....	Miss	14	25	....
Conn	....	....	7	La	8	50	....
Total	114	135	7	Total	200	336	....
Middle.				**Southwestern.**			
N. Y	41	44	17	Mo	93	7	....
N. J	....	26	3	Ark	90	153	....
Pa	257	179	61	Kan	10	....	....
Del	4	....	....	Tex	107	124	60
Md	108	18	55	Colo	63	22	23
Total	410	267	136	N Mex	....	....	10
North Central.				Ind. Ter	....	125	....
Ohio	120	216	35	Total	366	431	93
Mich	....	125	....	**Northwestern.**			
Ind	51	205	....	Ia	....	....	....
Ill	271	23	....	Minn	37	208	....
Wis	54	67	....	Neb	87	14	....
Total	496	629	35	S. Dak	215	....	....
South Atlantic.				N. Dak	180	....	....
Va	72	73	....	Wyo	10	....	....
W. Va	107	90	....	Mont	20	....	....
N. C	116	13	....	Total	579	222	....
S. C	9	16	....	**Pacific.**			
Ga	103	20	110	Cal	21	....	50
Fla	47	121	....	Ore	17	71	....
Total	517	313	110	Wash	255	4	....
Canada.				Ariz	42	....	....
Ont., P. Q., and En. Prov	107	45	33	Utah	52	....	....
Manitoba and Wn. Prov	161	107	....	Idaho	....	....	....
Total	268	152	33	Total	387	75	50

Total for the United States.—In process of construction, 3,069 miles. Surveyed or under survey, 2,458 miles. Projects of some promise, 431 miles.

From this table it will be seen that the North Central group has the largest mileage of new work projected, 1,160 miles. The South Atlantic states come next with 940 miles, and are followed by the Southwestern states with 890 miles, and the Middle and Northwestern states with 813 miles and 801 miles, respectively. An examination of the detailed list will show that the character of the prospective work in these several groups is much the same as for the four preceding years, with the exception that there are fewer long lines projected. Not more than 25 of the nearly 275 lines included are over 50 miles long, and the average length is much less than this, probably not over 20 miles. As these short lines are largely of local interest and importance, they require but little mention aside from the descriptions given in our detailed list. For the most part they are projected in localities needing better railway facilities and have a legitimate right to eventual success.

There are a few enterprises, however, which are of other than local importance and may be briefly mentioned. In Maine, the Bangor & Aroostook R. R. has surveyed and awarded the general contract for a line which, with its branches, will be about 230 miles long. About 95 miles have been partly graded and will be completed as soon as the weather will permit. The most notable line in the Middle States is the Wilkes Barre & Eastern R. R. now under construction from Wilkes Barre to Stroudsburg, Pa., 60 miles. In the North Central states, the Ohio Southern extension and the Lancaster & Hamden R. R. are projected and partly under contract for early extension, and in Indiana and Illinois, the Chicago, Indianapolis & Chattanooga Southern R. R. and the Chicago & New Orleans R. R. may be mentioned. By far the most important line under way in the Northwest is the extension of the Minneapolis, St. Paul & Sault Ste. Marie R. R. and Canadian Pacific Ry. through North Dakota and Assiniboia. It is probable that the greater part of this line will be completed this year. The completion of the line will give the Canadian Pacific a new line south of Lake Superior, and make it independent of the more northern line, which it is so costly to operate, especially during the winter months. Passing to the far western states, there is but one line of any great length which seems likely to be built this year, viz., the Portland & Puget Sound R. R., from Portland, Ore., to Seattle, Wash., 185 miles. This line was surveyed and partly graded by the Great Northern and Union Pacific companies about two years ago. The work was abandoned when the change in the management of the Union Pacific Ry. was made in 1890, and nothing has been done since except some additional surveying. The work involves the construction of a costly bridge over the Columbia River, near Portland, but is otherwise not unsually expensive.

Taking the country as a whole, there are 5,958 miles of railway projected which have a fair prospect of beginning work in 1893. This is a heavy decrease from the previous year's figures, but as explained elsewhere, they should not be taken at their face value. Again, it is probable that, as in 1892, a considerable amount of work will be done in double tracking and otherwise improving the roadbed and track of old lines.

SHOCKS IN AIR BRAKE TESTS.

We discussed at some length last week the lessons to be derived from the competitive tests of air brakes on the New York Central, but the importance of this matter at the present time justifies the allotment of some further space to its consideration. The public tests of brakes have educated both brake manufacturers and railway officers as to what are the essential requirements which the modern freight brake must meet; and this latest test brings many new facts to light which deserve careful study. The most important of these, doubtless, is the question of shock, which, as we said last week, has all along been the most difficult feature of the brake problem. The cause of shocks when brakes are applied is the fact that the brakes do not go on simultaneously throughout the train; and the time which is permissible between their application on the first car and the last car of a 50-car train has hitherto been an unsettled point. In previous tests the rate of application of the brakes has been timed by stop watches. In the New York Central tests an electric chronograph, in connection with pressure indicators connected to the brake cylinder, gave for the first time a reliable and closely accurate record of the time of application of the brakes. It is interesting to compare the results obtained in this manner with the requirements proposed by the M. C. B. committee on air brake standards at the Convention last June. They are contrasted in the following table:

	Time in seconds from the movement of engineer's brake valve to:	
	Entrance of air, 50th brake cyl.	55 lbs. pressure, 50th brake cyl.
M. C. B. limit	3.00	3.50
Westinghouse train (ave., 3 tests)	2.66	3.50*
New York train (ave., 3 tests)	3.15	5.90*

* Estimated.

The exact figures for the time to the attainment of 55 lbs. pressure in the brake cylinder of the 50th car are not at hand; but we have estimated them from the time when full pressure was attained in that cylinder, which were 3.56 seconds and 6.05 seconds for the Westinghouse and the New York trains, respectively.

Another requirement of the committee was that the same time of application should be attained in a test with three cars cut out. As will be seen by reference to Table II. in last week's issue, the effect of cutting out three cars was to increase by .09 second the time of application on the Westinghouse train, and by 0.88 second, the time of application on the New York train. Comparing now the M. C. B. requirements with the results attained in the tests, it would seem that the 3-second limit for the time from opening the brake valve to the entrance of air in the 50th brake cylinder was not far out of the way. The tests have shown that so slight a difference in time of application as 0.52 second is sufficient to increase the shock, as measured by slidometer movement, from about 3 ins. to 28 ins. The time of application on the New York train was 3.18 seconds, and it may be questioned in view of this, whether a reduction in time to the limit of 3 seconds named by the M. C. B. committee would be sufficient to reduce shock to a reasonable figure. On the other hand, it will be noticed that the longest time required for the Westinghouse brake's application in any test was 2.75 seconds, hence the M. C. B. committe cannot make a limit much less than 3 seconds without danger of establishing a standard too high to be practical.

The time limit set by the committee for the attainment of 55 lbs. pressure in the 50th brake cylinder, however, is manifestly too low, judged by the results of these tests. The Westinghouse brake barely attained it, and its competitor was nowhere near it. Similarly, it appears plain that the requirement that an equally good time record should be made with three cars cut out is too severe. It will inevitably take longer for tue application to run through the train under these conditions than with all brakes working, and some allowance should be made for this.

As stated by the Master Car Builders' Committee, these requirements are introduced to secure the minimum length of stop, and to minimize the shocks. The importance of the latter result is even greater than that of the former. A difference of a half-second in the time required for the brakes to apply on a long train will increase the length of stop from a speed of 30 miles per hour less than 22 ft.; but it may at the same time bring up the rear end of the train with a shock that will do a hundred dollars' worth of damage to cars or lading. There will be severe shocks enough in any event, from the unequal braking force due to brake pistons differently adjusted, foundation brake gear of varying strength, brake shoes of different metals, and cars carrying different loads or no load at all. But all these sources of shocks are as likely to offset one another as to work in unison; it is only the sluggish application in an emergency stop that can exert a cumulative shock throughout the train, hence too great pains cannot be taken to eliminate this so far as possible by the requirements of brake specifications.

The question why the New York brake experienced shocks in the New York Central tests, while it was free from them in the Burlington and Lehigh Valley tests, is one of much interest; and those who would study the problem may refer to the sectional view of the New York triple-valve, published in our issue of Feb. 13, 1892. If we may judge by results, some change has been made which has had the effect of retarding the quick action on the New York brake while aiding the release. It was suggested at the time of difficulty with the release in the Burlington tests of a year ago, that a heavier spring under the check valve in the passage from the train pipe to the brake cylinder might facilitate release. If this change has been made, it might be sufficient to cause a slight increase in time of application, for less than 1-100 of a second increase in the time taken to start the quick-action valve would be ample to explain the shocks which occurred to the train fitted with the New York brake.

LETTERS TO THE EDITOR.

QUEBEC, MONTMORENCY & CHARLEVOIX RY.

Sir: Permit me to correct some of the figures in the edition of Engineering News of Jan. 19. The bridge across the St. Charles River is joint property; the Quebec & Lake St. John Ry. and ourselves, owning each an undivided half. The station also is jointly owned in the same way. The first class cars, instead of $1,500 as stated, stand us $5,150 each; $3,750 at Wilmington, duty 35% and freight added. The second class cars cost $500 less, or $4,650, and the pilgrim cars $2,512 each. The cars were built 2 ins. wider than the original drawing, making them 10 ft. 2 ins. over all in width. Our working pressure instead of 140 lbs. runs from 145 lbs. to 160 lbs. on different engines, a considerable difference on the coal pile.

I am sorry I did not see you while here, and I hope you will visit us again next summer. I am building the bridge over the Grand River on the extension east of Ste. Anne de Beaupre and will have the track laid to Cape Tourmente, on the way to the Saguenay, by July 1. Yours, W. R. Russell.

Quebec, Feb. 21, 1893.

CONCERNING RIVET VALUES.

Sir: The query under the heading "Concerning Rivet Values" in the issue of Engineering News for Dec. 1, 1892, takes up one of the most interesting questions met with in practical bridge building. As stated in his letter the aim of your correspondent is to obtain information in regard to the proportion of the total strain borne by the different rows of rivets in a riveted joint. The only reply so far published (Eng. News, Dec. 8, 1892) refers to tests in which the elastic limit was exceeded. These are not the only tests which have been made (see Eng. News, Jan. 2, 1892, and also tests made in Vienna on riveted girders by the Austrian Society of Civil Engineers, and more recently on riveted joints by F. Zimmerman, in Strassburg, Germany, published in pamphlet form by Ernst Korn, Berlin), but for determining the question under consideration, however, I believe them all to be of limited value. This is (1) because the proportion of the strain borne by the different rows of rivets is due to the elasticity of the material riveted, and (2) because the friction has to be overcome before there is any shearing strain on the rivets. The actual distribution of the strain depends upon both the elasticity and the friction. If these conditions are changed, that is, friction and elasticity overcome, the proportionate strain will be quite different, and we cannot expect to obtain a correct idea of it from permanent set or injury. I would also state that your correspondent's statement that "we must to a great extent rely on friction" in riveted joints is a well known fact. That an examination for "shaking" rivets has always been one of the most important details of bridge inspection is a proof of this. The French authors alluded to gave us figures for friction which I consider were reliable for bridge work only; viz. 10,000 lbs. to 20,000 lbs. for hand riveted joints and from 13,000 lbs. to 24,000 lbs. for machine riveted joints. Weyrauch, the well known German author, gives for friction from 11,000 lbs. to 22,000 lbs. per sq. in. of riveted section. That is to say the friction alone will keep the joint intact without any shearing strain on the rivets. By neglecting friction we tend to increase the security of our joints in actual construction, but if we wish to know the relative proportion of the strain borne by the different rows of rivets we must take it into consideration.

The question as to how elasticity and friction work together is an open one. That it is a difficult question even under the simplest conditions can be seen from the following illustration: Suppose there is a heavy box on the sidewalk which is fastened to the door post by a strong cord. An unsuccessful attempt has been made to steal this box and we are called in as an expert to decide whether it was the friction of the box on the sidewalk, or the strength of the cord, or both, which prevented the thief from accomplishing his object. If we know whether the cord was loose or tight before the thief's visit we can formulate an opinion. If we do not know this we cannot tell whether the thief was prevented by the friction of the box or by the elasticity of the cord by which it was fastened. The conditions are nearly the same in the case of a riveted joint. As we do not know what strain gets into the joint during erection we cannot tell which force is prevelant.

In experimenting with soft material we change the standard conditions for riveted joints just as we do if we consider friction and elasticity as overcome as mentioned before. Mr. Gravelle states that such experiments have shown him that the first and last rows of rivets do most of the work. If he means as shown in Fig. 1 that the first row takes $P \div 2$, the other half of P will be compelled to pass over the intermediate rows without loss to the last row in order to preserve the balance. This would be odd, indeed. In no case does it seem more probable than the common theory as shown in Fig. 2. The probability is that in a riveted joint one row of rivets does get the largest share of P. Which one this is seems to depend mostly upon the defects in workmanship.

The following calculations give us some further points. In these we must distinguish between concentric joints, where the axial position of the strain remains the same, and eccentric joints where the strain is transmitted from one center to another by a bending moment. The first case is very well known and is only introduced to show the difference (see Fig. 3). There we have a strain per unit of area $S = P \div F$. If we call d the thickness of the plate and consider a strip one unit wide $F = d$ and

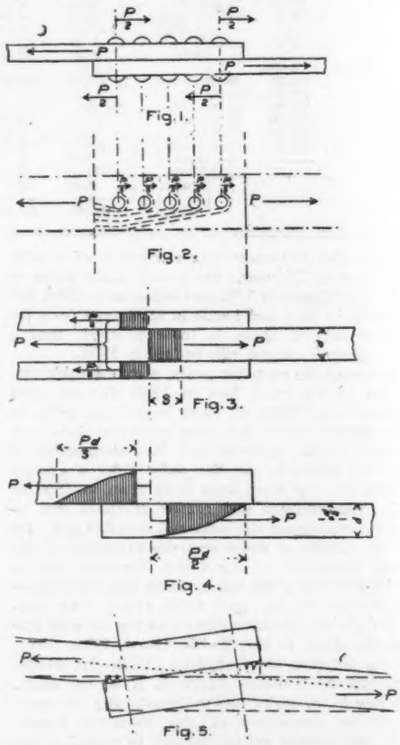
$$S = \frac{P}{d} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

In the case which Mr. Gravelle shows in his letter, the tension P produces a bending moment as shown in Fig. 4, and we obtain the maximum strain per unit of area by the well known formula, $S^1 = \frac{P}{F} + M\frac{t}{T}$.

Being $R = \frac{T}{t} = \frac{d^2}{6}$. The maximum movement $M = \frac{Pd}{3}$. This cannot be proved except by an operation of some length. It is, however, exact enough if we remember that $M = \frac{Pd}{2}$ in case the rivet is fixed horizontally and that the diminution to $\frac{Pd}{3}$ is due to its inclined position. This value substituted in the formula gives us

$$S^1 = \frac{P}{d} + \frac{6}{d^2} \times \frac{Pd}{3} = \frac{P}{d}(1 + 2) = 3S \quad (2)$$

If then one row of rivets, which is calculated for $P \div 5$ (see Fig. 2), gets $P \div 2$, its strain, or, more correctly the strain in the surrounding sheet, will be $S'' = 7.5S$.



Strains In Riveted Joints.

That is, there will be rupture. The value of these figures is diminished by the tendency of the sheets to bend. It may happen that the sheets joined are not stiff enough, and that the joints are too strong in proportion. In this case the joint will be distorted as shown in Fig. 5, and the metal will crack and break at the two outer rows of rivets. In Mr. Gravelle's experiments this seems to have been the condition.

Although the above exact calculation is scarcely known there is no bridge man who does not understand the danger in using single-shear, eccentric joints, and no one will use them except when actually necessary. I believe the joint shown in the engraving accompanying Mr. Gravelle's communication is the most dangerous of riveted joints, and I might object to its use in bridge construction, especially in cases of compression, as he does. Such joints are in use in water-tight structures where tightness is the principal thing sought after. Finally I wish to state that I heartily join with Mr. Gravelle in the desire to obtain more knowledge of the question propounded by him, and such tests as have been made to determine it. I think the results of such tests would be of real scientific value. The only one I know of was made with tuning-forks, and these are of

little value, because rivets are never equally strained. I will not, at present, make public a method for making such tests which I have in view, partly because its correctness is not entirely settled in my mind and partly because I am doubtful whether a similar method has not already been used in experiments. I will, therefore, postpone any publication of it until after further investigation. Meanwhile, I hope that some further enlightenment will be given us on the subject in question.

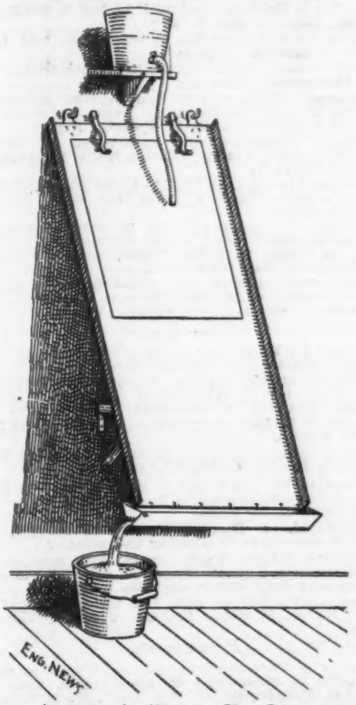
Friedrich Edler von Emperger,
Mem. Austrian Soc. C. E.

New York.

WASHING BLUE-PRINTS.

Sir: I have been considerably troubled at various times in my practice to find a suitable method of washing blue-prints. I at last devised the apparatus here shown, which I think combines the qualities of cheapness in first cost, efficiency and ease of manipulation.

This apparatus consists of a piece of sheet-iron, large enough for the largest print, with the side edges turned up and the upper end screwed or hung to the wall.



Apparatus for Washing Blue Prints.

The lower edge has fastened to it a tin gutter arranged to drain into a bucket. The sheet-iron is propped out from the wall about one foot, and this prop may be arranged to drop down by a hinge, so that the whole thing will be out of the way when not in use. Above the iron is a shelf supporting a bucket of water with a small hose and stopcock attached. Two springs hold the print in place. One bucket of water will wash two prints 28 × 42 ins.

Yours truly,
S. P. Baird.

Portsmouth, O., Jan. 2.

VARIATIONS IN WHEEL FLANGES.

Sir: The article by Superintendent Rhodes on, "Wheel Flanges and Their Gage," in your issue of Feb. 2, will no doubt attract the attention of Master Car Builders and will result in much good to the rolling stock, and more good to the track.

It is a question which affects the whole train movement of our country; and if we propose to run trains at 100 miles per hour, it will not answer to have any strife between the wheels and the track.

The most delicate, and perhaps the most dangerous part of a train's movement, is its passage over a switch. At this point for an instant the whole design of the flanged wheels is abandoned. While passing over a frog, instead of the face of the flange bearing on the main rail, the back of the flange is depended upon—being guided by the guard rail. The distance between a guard rail and the wing of a frog is 4 ft. 5 ins., and this is rigid—with no variation.

Now, what happens? Why the M. C. B. Association accepts wheels to run with minimum distance between their backs of 4 ft. 5 ins. These wheels are run through the frog at 40 or 50 miles per hour, causing destruction to frog and guard rails that only the track foreman knows of, and he is beginning to think that it is necessary.

The destruction to the frog is not all that happens. For when one of these "minimum" pairs of wheels with 4 ft. 5 ins., or 4 ft. 4⅞, or less, as can be found in service, is forced through a frog, with everything solid, it may cause a broken flange, a loose wheel, or a bent axle. This damage may not be discovered until long afterward, when cause and effect are so far removed that the real difficulty is not discovered.

So much for switches on straight track. When a switch is on a curve all these are aggravated. If the guard rail is on the inside of the curve, it has to do double duty; for it must catch every wheel on that side of the train, and hold it away from the frog point. If, on the contrary, the frog is on the inside of the curve, you will find the wing of the frog doing guard rail duty, and being yanked by every pair of wheels which has 4 ft. 5⅜ ins. or less between the backs of flanges.

The life of a frog is not always determined by the wear on the top of the rail. Loose rivets, worn out bolts and keys, and yoke bands out of place frequently settle the matter, and the destruction comes from these illegitimate wheels.

There should be a gage of 4 ft. 5⅜ ins., with little or no variation, for the backs of wheels, and these figures should be strictly adhered to on all roads.

Dunmore, Pa., Feb. 13, 1893. A. D. B.

VARIABLE EXHAUST NOZZLES ON TRACTION ENGINES.

Sir: The variable nozzle of which you have a cut and description in your issue of Feb. 2, and which is claimed and patented by Mr. Geo. Macallan, Superintendent of the Stratford shops of the Great Eastern Ry., was used upon our traction engines from 1885 until 1890, during which time we put out about 1,500. It was finally discarded three years ago, as not giving the satisfactory results that should be obtained from an exhaust; and we substituted another which gives far better results. I know of two or three others which are upon the market that will excel the Macallan nozzle where a variable exhaust is required, as it is upon the traction engine, which has to make steam from all kinds of fuel and in all sorts of locations.

Yours respectfully, F. E. Hemstreet,
Mechanical Engineer of the Minnesota Threshing Machine Co.

Stillwater, Minn., Feb. 6, 1893.

THE SULPHUR FUME NUISANCE AT BUTTE, MONTANA.

Sir: I note your remarks on p. 9, of your issue of Jan. 5, under the head of "An Opportunity for Chemical Manufacturers." It is possible that a chemical solution of our smoke problem may be attained, but this field has not been entirely overlooked in our discussions of this subject here. Mr. C. W. Stickney has proposed a method of precipitating the sulphur in solid form by the application of aluminum to the roasting process; and though the chemical reactions, it must be conceded, would occur as desired, the general opinion of those who examined his plans seems to be that too many delicate adjustments, both mechanical and of temperature, are required to make the plan successful.

The manufacture of acid has often been suggested, and several other schemes of more or less practical importance have been discussed, but a serious objection of some character seems to be offered against everything so far proposed. The fact is that the amount of Butte's sulphur when converted into acid is likely to surprise those who are not familiar with the subject and well informed upon what our smelters are doing. I expect very shortly to gather more reliable data upon this subject than I have at the present writing, but I estimate the output of concentrated sulphuric acid, if all the sulphur driven off were utilized in this way, at between 750 and 1,000 gross tons every 24 hours. As the watershed above the smelters is probably something less than 40 sq. miles in area, no plan which contemplates the discharge of any considerable proportion of this amount of acid in its active form into the stream can be considered. Some plan for utilizing the acid should accompany any plan which contemplates its manufacture. For my own part I am inclined to believe that true economy points to the combination of the flue with some practical chemical method.

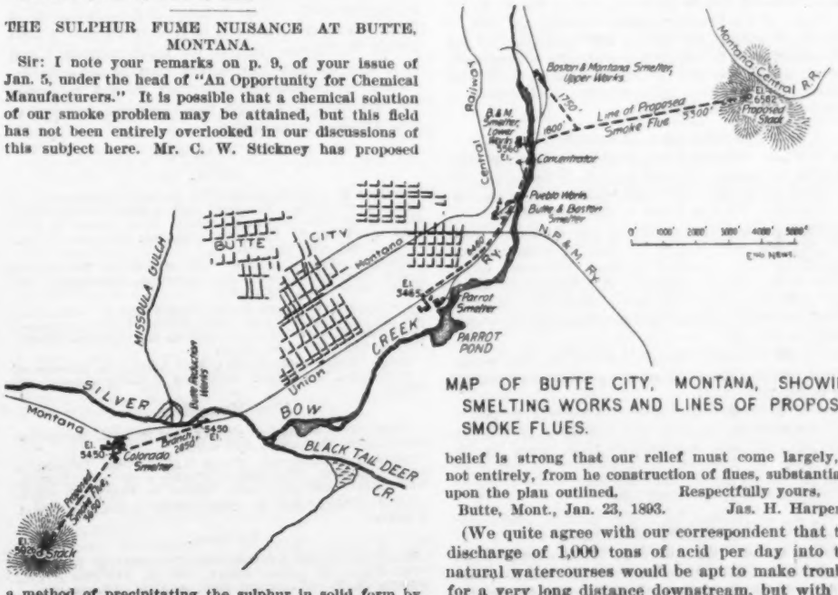
Dr. E. D. Peters, Jr., has a plan which I think possesses some merit, as he proposes to use the acid formed to assist in the production of copper.

A portion of our works are so situated that efficient flues may be built without very great expense, while others are so located that the building of a flue would perhaps (all other things considered), exceed the cost of moving the plant. The sulphur fume problem is a very important and promises to be a very interesting question in connection with Butte's production of copper. Work in other localities can hardly be compared with our work here, for nowhere else on the globe, so far as I am informed, do they attempt to work the class of ore we produce, in the quantities treated here. As I write, the fumes are fairly stifling in the streets at a distance of more than a mile from the nearest smelter.

Though all Butte regards this question of great importance, we may as well confess that we have hardly entered upon a systematic study of the subject. One trouble is that many of our people are still looking for some "cheap John" method of abating this nuisance. I do not believe that it can be done without the expenditure of considerable money, and when our people more fully realize this fact we will be prepared to formulate and execute some plan of relief. This field is certainly an excellent one for practical work in this line, and I believe that any capital which will undertake to back a sensible, practical scheme for the utilization or dissipation of these noxious fumes can make very excellent terms and reap a rich reward from our people here.

I send a tracing which will show the relative location of several of the reduction works and the city of Butte. The proposed route for flues is indicated, with the elevations above sea level at the terminals. We are no nearer active work upon any plan now than we have been for some time past, but certain it is that something, sooner or later, must be done, and my belief is strong that our relief must come largely, if not entirely, from he construction of flues, substantially upon the plan outlined.

Respectfully yours,
Butte, Mont., Jan. 23, 1893. Jas. H. Harper.



MAP OF BUTTE CITY, MONTANA, SHOWING SMELTING WORKS AND LINES OF PROPOSED SMOKE FLUES.

(We quite agree with our correspondent that the discharge of 1,000 tons of acid per day into the natural watercourses would be apt to make trouble for a very long distance downstream, but with all the mining and metallurgical and chemical works now in operation in the Rocky Mountain region and the far West it ought to be possible to find a market at some price for even this large output of acid, or at least of the greater part of it.

The following from Roscoe & Schorlemmer's Chemistry is of interest in this connection.—Ed.)

The whole of the sulphur contained in the copper ore comes off, in the process of roasting, in the form of sulphur oxides, and in most cases all this gas is discharged into the atmosphere from the chimneys of the copper-works. This copper smoke has long been a source of damage and annoyance to those residing in the neighborhood of the smelting-works, and many attempts have been made to abate the nuisance by endeavoring to condense the fumes, which not only contain large quantities of sulphurous and sulphuric acids, but likewise arsenic trioxide and sometimes hydrofluoric acid. The passage into the air of arsenic trioxide, and of dust containing copper and other mat-

ters, may be almost entirely avoided by allowing the furnace gases to pass through long and wide flues before they reach the stack. But the acid vapors cannot thus be condensed. For this purposes the gases from the roasters may be passed into ordinary leaden sulphuric acid chambers, together with steam and nitrous fumes, and thus the sulphur dioxide condensed to marketable oil of vitriol. This process is now carried out by some few copper smelters, especially by Messrs. Vivian at the Hafod works, and by Messrs. Newton, Keates & Co., at St. Helens. It is, however, found impossible thus to condense more than about 40% of the total sulphur gases sent off during the processes of copper-smelting, for in certain of the operations, as in the roasting of the white metal to yield blister-copper, the temperature required to bring about the reaction is so high, and therefore the dilution of the acid gases with air so great, that it has not been possible to make vitriol with this product. Nevertheless, by the adoption of measures already shown to be feasible, much of the nuisance and damage caused by copper-smoke can be prevented.

SUSTAINING POWER OF ICE.

Sir: Can you inform me through the columns of Engineering News how much weight will be sustained by ice 20 ins. thick on a river half a mile wide, and oblige. Respectfully, S. D.

Sault Ste. Marie, Mich., Jan. 19, 1893.

(By army rules, 2-in. ice will bear infantry (not too close together, we infer), 4-in. ice, cavalry or light guns; 6-in. ice, heavy field guns of the 1850-1860 standard; and 8-in. not over 1,000 lbs. per sq. ft. on sledges. At the Des Jardines Canal disaster, near Hamilton, Ont., March 17, 1857, a train fell 60 ft. onto ice 2 ft. thick. The locomotive and tender broke through it, but a following passenger car, which fell on its roof, a little to one side, and was then struck a square blow by the next following car, did not break through. Railway tracks have been repeatedly laid on the ice across our Western rivers and operated for months together; and with ice as thin as 15 ins., if we remember correctly.—Ed.)

THE DUNNING'S DAM.

Sir: In regard to Mr. E. S. Gould's communication, in your issue of Feb. 9, 1893, concerning the credit for the design of the Dunning's dam, I would say that he is right as regards my having any knowledge of my name being used in any way in the pamphlet entitled, "History of the Portland Cement Industry in the United States." Yours truly, Robt. Reaves.

Scranton, Pa., Feb. 20, 1893.

NOTES AND QUERIES.

W. S. C., of Meriden, Conn., asks concerning a plumb-bob with an adjustable steel center. He says he has seen such an article advertised as for sale. Can any of our readers tell him where it can be secured?

An engineer inquires concerning any published work upon "current motors." If by this is meant wheels operated by the current of a river, we would refer him to D. K. Clark's "Manual for Mechanical Engineers" for some data upon this subject. We know of no work especially devoted to discussing current wheels or motors.

Mr. W. W. Cochrane, Harper's Ferry, W. Va., wants to know whether the shiny or the plain side of tracing cloth ought to be used.

For any purpose that makes it necessary to photograph the drawing the plain side is slightly preferable. But, if the shiny side is not greasy (if it should be, the grease may be removed by rubbing with chalk or starch or tobacco ashes), finer and sharper lines can be drawn upon it than the plain side.

I. W. B., of Pittston, Pa., who inquires concerning the agreement of English steel tapes with U. S. standards in our issue of Feb. 23, is answered as follows by the Keuffel, Esser Co.: "Tables for Converting Customary and Metric Weights and Measures" is the title of a publication issued by Mr. T. C. Mendenhall, Superintendent of U. S. Coast and Geodetic Survey, Washington, D. C. This publication fully answers the query of our correspondent, and can be obtained at the address given.

The Navy Department has contracted with E. W. Bliss & Co., of Brooklyn, for launching and other apparatus for Whitehead auto-mobile torpedoes, and with the American Projectile Co., of Lynn, Mass., for wrought steel shells. The first contract amounts to $222,000, and the second to about $100,000. The Bliss contract calls for 50 broadside and upper-deck torpedo-mounts, with tubes, connections, air-compressors, etc. The American projectile Co. is to furnish 10,000 4-in., 3,000 5-in., 1,500 8-in., 50 10-in. and 100 12-in. shells, at $3.40 and $5.10 each for the 4 and 5 in. shells, and 10, 12 and 15 cts. per pound each for the 8, 10 and 12 in. shells.

STATISTICS SHOWING THE TRACK LAYING OF 1892 AND THE PROSPECTIVE RAILWAY CONSTRUCTION OF 1893.

(With Map No. 47.)

Owing to the considerably decreased activity in railway construction and the unusual demands which will be made upon our space by the presentation somewhat fully of the many features of engineering interest at the coming World's Columbian Exhibition, we have decided to discontinue for the present year the regular publication of our usual sectional maps showing the progress of railway construction in the United States. At the same time, it is our intention to keep our records accurately up to date, and to publish at such times as the changes in the field of new railway construction seem to demand it (at least twice during the present year) general summaries of the work being carried on and in prospect. In this issue we present the first of these summaries. As will be seen, the following list includes the tracklaying of 1892, usually published separately, and such lines of railway as have some fair prospect of being completed or placed under contract or construction during the current year. It should not be understood from this that all or nearly all of these lines will be placed under contract or construction this year, neither do we mean, on the other hand, that the enterprises described have a mere fighting chance of beginning actual work during 1893. The list presents simply a fair statement of the lines upon which engineers and contractors have a prospect of securing work during the coming season. Although it is presented, of course, with no such claims to accuracy as we make for our statistics of actual tracklaying, we believe it to include but few, if any, wild-cat enterprises or doubtful schemes; and studied with this understanding we trust the map and list will prove a valuable guide to our engineer and contractor readers in planning their season's work. Concerning the many enterprises omitted from our map as having little or no prospect for active work in 1893, we shall be pleased to receive further details giving additional reasons for their inclusion; and in a like manner any which may be wrongly included or incorrectly described in the following list, we shall be pleased to correct upon receipt of well attested information.

NEW ENGLAND.

Maine.

Bangor & Aroostook.—Partly graded, Brownsville to Houlton, 94 miles. Surveyed and general contract let, Houlton to Van Buren, 83 miles; Dyer Brook to Ashland, 43 miles; Ft. Fairfield to Easton, 12 miles. Contr., C. P. Treat, Chicago, Ill.

Georges Valley.—Partly graded, West Warren to Union, 8 miles. Contr., Jas. Mitchell, Bucksport. Ch. Engr., Wm. Lee, Bucksport.

Portland & Rumford Falls.—Track laid in 1892, Canton to Rumford Falls, 14.6 miles. Under contract, Mechanic Falls to Maine Central R. R., 12 miles. Contr., John Berry, Fayville, Mass.

Total.—Track laid in 1892, 14.6 miles. In process of construction, 114 miles. Surveyed or under survey, 138 miles.

New Hampshire.

Brookline & Pepperell.—Track laid in 1892, Massachusetts line to Brookline, 5.75 miles.

Concord & Montreal.—Track laid in 1892, Bowman's to Berlin Falls, 14.8 miles; Parker's to New Boston, 5.17 miles. Surveyed, East Exeter to Epping, 5 miles.

Total.—Track laid in 1892, 25.72 miles. Surveyed, 5 miles.

Vermont.

Black River.—Under contract, Proctorsville to Claremont Junc., 29 miles. Contr., W. E. Dorwin & Co., Owego, N. Y. Ch. Engr., Geo. A Ayre, Perkinsville.

Total.—Under contract, 29 miles.

Massachusetts.

Brookline & Pepperell.—Track laid in 1892, Groton to N. H. line, 11.75 miles.

Plymouth & Middleboro.—Track laid in 1892, Plymouth to Middleboro, 15.69 miles.

Southbridge, Sturbridge & Brookfield.—Surveyed, Brookfield to Southbridge, 13 miles. Ch. Engr., Arthur C. Moore, Sturbridge.

Total.—Track laid in 1892, 27.44 miles. Projects of some promise, 13 miles.

Connecticut.

New York & Danbury.—Projected, Danbury to Golden's Bridge, N. Y., 14 miles. (7 N. Y., 7 Conn.)

New York, New Haven & Hartford.—Track laid in 1892, West River Branch near New Haven, 0.62 mile.

Total.—Track laid in 1892, 0.62 mile. Projected, 7 miles.

Total, New England States.—Track laid in 1892, 68.38 miles. In process of construction, 143 miles. Surveyed or under survey, 156 miles. Projected, of some promise, 14 miles.

MIDDLE.

New York.

Adirondack & St. Lawrence.—Track laid in 1892, between Poland and Malone, 140 miles; Prospect Junc. to Hinckley, 4 miles; Lake Clear Junc. to Saranac Lake, 6 miles.

Binghamton & State Line.—Surveyed, Binghamton to the Pa. line, 15 miles; Pres., Jos. P. Noyes, Binghamton.

Buffalo & Geneva.—Under construction, extension of Rochester & Honeoye Valley R. R., 2.6 miles.

Catskill & Tannersville.—Under construction, Otis Elevating Ry. to Kaaterskill Ry., 1½ miles. Contrs., Mairs & Lewis, New York city.

Cooperstown & Charlotte Valley.—Track laid in 1892, West Davenport to Davenport Center, 2.12 miles. Surveyed, Davenport Center to East Davenport, 4 miles. Secy., Geo. Brooke, Cooperstown.

Dutchess County.—Track laid in 1892, near Hopewell, 1 mile.

Gouverneur & Oswegatchie.—Track laid in 1892, Gouverneur toward Edwards, 3 miles. Tracklaying in progress, 3d mile east of Gouverneur to Edwards, 12 miles.

Lehigh Valley.—Track laid in 1892, Rushville to Rochester, 4 miles; 5th mile north of Van Ettenville to Geneva, 53.72 miles.

Le Roy & Pavilion.—Projected, Le Roy to Pavilion, 10 miles. Chas. H. Root, Le Roy.

Little Falls & Dolgeville.—Track laid in 1892, Little Falls to Dolgeville, 10.5 miles.

Long Island.—Under construction, Hempstead to Valley Station, 6.04 miles.

Middlesex Valley.—Track laid in 1892, Stanley to Naples, 22 miles. Under survey, Naples to Perkinsville, 14 miles. Ch. Engr., R. F. Uniacke, Naples.

Niagara Junction.—Under construction, at Niagara Village, 4 miles. Contrs., Mairs & Lewis, 18 Broadway, New York, N. Y.

Saranac Lake & Lake Placid.—Under survey, Saranac Lake to Lake Placid, 11 miles. Ch. Engr., Jesse S. Mott, Saratoga.

Unadilla Valley.—Track laid in 1892, Bridgewater to Leonardsville, 5 miles. Under construction, Leonardsville to Berlin, 15 miles. Treas., Fred. F. Culver, 80 Broadway, New York, N. Y.

Total.—Track laid in 1892, 251.34 miles. In process of construction, 41.14 miles. Surveyed or under survey, 44 miles. Projects of some promise, 17 miles.

New Jersey.

Central R. R. of New Jersey.—Track laid in 1892, Atlantic Highlands to Highland Beach, 4 miles.

Lake Hopatcong, Boonton, Morristown, Caldwell & New York.—Located, Caldwell to Rockaway, 17 miles; branch, Whippany to Morristown, 7 miles.

Lehigh & Hudson River.—Surveyed, Franklin to Zinc mines, 2 miles.

Lehigh Valley.—Track laid in 1892, extension of Perth Amboy & Raritan River R. R., 4½ miles.

Pennsylvania.—Track laid in 1892, Winslow to Richland, 11.5 miles; Richland to Seaville, 22 miles; various short branches, 5.6 miles.

Philadelphia & Reading.—Track laid in 1892, Pt. Reading crossing to Pt. Reading 19.6 miles.

Rockaway Valley.—Track laid in 1892, Mendham to nr. Morristown, 7 miles. Projected, extensions to Morristown and State Insane Asylums, 3 miles.

Total.—Track laid in 1892, 74.2 miles. Surveyed or under survey, 26 miles. Projects of some promise, 3 miles.

Pennsylvania.

Altoona & Philipsburg Connecting.—Under contract, Janesville to Philipsburg, 20 miles. Pres., Saml. P. Langdon, Philadelphia, Pa. Ch. Engr., W. T. Forsyth, Houtzdale.

Altoona, Clearfield & Northern.—Track laid in 1892, Wapsononock to Dougherty, 5 miles. Located, extension to Allentown, 1.5 miles. Projected, Dougherty to Coalport, 12 miles. Ch. Engr., W. T. Forsyth, Houtzdale.

Baltimore & Ohio.—Track laid in 1892, Uniontown to Smithfield, 10.2 miles.

Bare Rock.—Track laid in 1892, Way Station to Bare Rock, 2.5 miles.

Beech Creek.—Track laid in 1892, Kermoor to Mahaffey, 11.8 miles.

Bellefonte Central.—Track laid in 1892, Strouble to State College, 1 mile.

Bloomsburg & Sullivan.—Surveyed, Jamison to Gonaga Lake, 13 miles. Ch. Engr., F. M. Leader, Bloomsburg.

Buffalo & Susquehanna.—Track laid in 1892, Hulls toward Galeton, 3 miles. Graded, 3 miles from Hulls to Galeton, 17 miles, and 4 miles of track laid. Ch. Engr., C. E. Botsford, Cherry Springs.

Buffalo, Rochester & Pittsburg.—Track laid in 1892, Howard Junc. to Mt. Jewett, 21 miles. Tracklaying in progress, Clearfield to Jefferson line, 26.25 miles. Ch. Engr., J. M. Floesch, Clearfield.

Clarion River.—Track laid in 1892, Carman to Croyland, 1 mile.

Coudersport & Port Allegheny.—Surveyed, Coudersport to Ansonia, 28 miles. B. A. McClure, Coudersport.

Cumberland Valley.—Projected, State line Cumberland, Md., 60 miles. (Pa. 5, Md. 55.)

Delaware River & Lancaster.—Projected, St. Peters to Lancaster, 33 miles.

Delaware, Susquehanna & Schuylkill.—Track laid in 1892, on branches, 5.6 miles.

Eagle's Mere.—Track laid in 1892, Sonestown to Eagle's Mere, 8 miles.

Emporium & Rich Valley.—Track laid in 1892, Big River to Bustard Hollow, 3 miles.

Fall Brook.—Under contract, Mills to Ulysses, 7.1 miles. Ch. Engr., S. T. Hayt, Jr., Corning, N. Y.

Granite Hill.—Track laid in 1892, Granite Station to Granite Hill, 1 mile.

Hunter's Run & Slate Belt.—Track laid in 1892, Pine Grove Furnace to slate quarry, 6 miles.

Ketner, Elbon & Shawmut.—Track laid in 1892, Healey to Swamp Creek, 0.75 mile. Surveyed, Glen

Hazel to Shawmut, 25 miles. Supt., C. D. Williams, Ridgeway.

Keystone.—Track laid in 1892, near Gardeau, 4 miles. Projected, Gardeau to Monroe, 7 miles.. Pres., H. C. Rich, Emporium.

Kishocoquilias Valley.—Track laid in 1892, Reedsville to Alexanders, 5.82 miles. Under construction, Alexanders to Belleville, 4.5 miles. Ch. Engr., F. F. Whittekin, Tionesta.

Lehigh Valley.—Track laid in 1892, Loyalsock R. R.: Bowman's Creek to Harvey's Lake Junc., 2 miles. Thorndale Branch: Moss Creek to Thorndale, 1 mile. Wilkes-Barre and Harvey's Lake R. R.: Harvey's Lake to Bowman's Creek, 12 miles. Track laid in 1893, Copley to Egypt, 1.5 miles.

Mt. Jewett & Smethport.—Track laid in 1892, near Mt. Jewett to Hazlehurst, 6 miles.

Newport & Sherman's Valley.—Track laid in 1892. Blain to New Germantown, 3.7 miles. Under construction, Valley Sta. to New Bloomfield, 3 miles. Partly surveyed, New Germantown to South Broad Top coal fields, 30 miles. Pres., David Gring, Newport.

Oregon & Texas.—Track laid in 1892, Cammal to Summit, 6.5 miles. Partly graded, Summit to English Center, 7.5 miles.

Pennsylvania.—Track laid in 1892 on various extensions and branches, 70 miles. No details of proposed work can be obtained. Probably from 40 miles to 60 miles of new line will be built in the state in 1893.

Perry County.—Track laid in 1892, New Bloomfield to Green Park, 4 miles. Track laid in 1893, Green Park to Landisburg, and Green Park to Loysville, 7 miles. Surveyed, Landisburg to Dubling Springs, 6 miles.

Philadelphia & Reading.—Track laid in 1892, Tamaqua, Hazleton & Northern extension, 4.2 miles; Bloomsburg Belt R. R., 0.3 mile. Under construction, Philadelphia & Frankford R. R.: Philadelphia to Frankford, 6 miles. Philadelphia & Northern R. R.: Wistar Sta. to N. E. Pa. R. R., 5 miles. Philadelphia & Newton Connecting R. R.: Tabor Branch to Philadelphia & Newton R. R., 1.12 miles. Surveyed, Philadelphia & West Chester R. R.: Exton to West Chester, 6 miles.

Pittsburg & Lake Erie.—Track laid in 1892, Ellwood Junc. to coal mines, 3.5 miles.

Pittsburg, Shenango & Lake Erie.—Track laid in 1892, Lexington to Ohio Line, 7.4 miles.

Sugar Run.—Track laid in 1892, Shaffer's Dock to timber lands, 8.5 miles.

Susquehanna.—Track laid in 1892, Costello to Hulls, 13 miles.

Tionesta Valley.—Projected, extensions aggregating 4 miles.

Tionesta Valley & Hickory.—Track laid in 1892, Parrish to Howland, 2.25 miles. Graded, Nebraska to Ross Run, 5 miles. Ch. Engr., T. D. Collins, Nebraska.

Tuscarora.—Track laid in 1892, Port Royal to East Waterford, 18 miles.

Wellsville, Coudersport & Pine Creek.—Track laid in 1892, Genesee to Perryville, 1.87 miles.

Western Maryland.—Track laid in 1892, Porters Sta. to Manges Mill, 3 miles. Under construction, Manges Mill to York, 12 miles.

Wilkes-Barre & Eastern.—Track laid in 1892, Pocono west, 3 miles. Under construction, Wilkes-Barre to Stroudsburg, 57 miles. Ch. Engr., T. E. Hartwell, Wilkes-Barre.

Williamsport & North Branch.—Under construction, Nordmont to Dohm's Summit, 18 miles.

Williams Valley.—Track laid in 1892, Brookside to Lykens, 12 miles.

Total.—Track laid in 1892, 271.89 miles. In process of construction, 256.97 miles. Surveyed or under survey 179.5 miles. Projects of some promise, 61 miles.

Delaware.

Odessa & Middletown.—Graded, Odessa to Middletown, 4.25 miles. Secy., W. R. Polk, Wilmington.

Total.—Graded, 4¼ miles.

Maryland.

Baltimore & Drum Point.—Partly graded, Baltimore to Drum Point, 82 miles. Pres., Aug. Albert, Baltimore.

Baltimore & Ohio.—Track laid in 1892, Linden to Chevy Chase Sta., 2 miles; Childs Sta. toward Providence Mills, 3.5 miles. Under construction, Chevy Chase Sta. to Fairfax, Va., 23 miles. (8 Md. 15 Va.) Surveyed. 3.5 miles north of Childs Sta. to Oxford, Pa., 9 miles. (4 Md., 5 Pa.)

Pennsylvania.—Track laid in 1892, Claremont Branch R. R.: London Park to Claremont Stock Yards, 1.2 miles.

Takoma, Burnt Mills & Sandy Springs.—Surveyed, Takoma to Sandy Springs, 14 miles. Pres., C. G. Stone, Brightwood, D. C.

Washington & Chesapeake Beach.—Under contract, Washington, D. C., to Chesapeake Beach, 18 miles. Secy., T. W. Tyrer, Washington, D. C. Ch. Engr., L. H. Hyer, Washington, D. C.

Total.—Track laid in 1892, 10.7 miles. In process of construction, 108 miles. Surveyed or under survey, 18 miles. Projects of some promise, 55 miles.

Total, Middle States.—Track laid in 1892, 608.13 miles. In process of construction, 410 miles. Surveyed or under survey, 268 miles. Projects of some promise, 136 miles.

NORTH CENTRAL STATES.

Ohio.

Baltimore & Ohio.—Projected, Cleveland, Wooster & Muskingum Valley R. R., Lodi to Cleveland, 35 miles.

Cleveland Belt.—Track laid in 1892, belt line at Cleveland, O., 7 miles.

Cleveland, Canton & Southern.—Track laid in 1892, Navarre to Warwick mine, 8 miles.

Columbus, Lima & Milwaukee.—Partly graded, Lima to Defiance, 40 miles. Pres. Hylas Sabine, Marysville. Ch. Engr., H. A. Schwanecke, Pittsburg, Pa.

Dayton, Lebanon & Cincinnati.—Track laid in 1892, Kerby's Crossing to Lebanon, 6.8 miles.

Findlay Belt.—Track laid in 1892, at Findlay, O., 6.25 miles.

Findlay, Ft. Wayne & Western.—Track laid in 1892, M. & E. Canal to Cincinnati, Jackson & Mackinaw R. R., 11.2 miles. Under construction, C. J. & M. R. R., to Ft. Wayne, Ind., 28 miles. Ind. 18, Ohio 10. Ch. Engr., B. W. Fenton, Findlay

Lancester & Hamden.—Surveyed, Laurelville to Wellston, 40 miles; Locust Grove to Union Furnace, 10 miles; C. & M. V. Junc. to Columbus, 26 miles. E. P. Buell, Tarlton.

Ohio Southern.—Under contract, Springfield to Lima, 63 miles. Contrs., McArthur Bros., Chicago.

Pittsburg, Akron & Western.—Partly graded, Akron to Mogadore, 7 miles.

Pennsylvania.—Track laid in 1892, Sabineville Coal R. R., 3.07 miles; at East Toledo, 0.71 miles.

Pittsburg, Ohio Valley & Cincinnati.—Track laid in 1892, extension to Powhattan, 6 miles.

Pittsburg, Shenango & Lake Erie.—Track laid in 1892, Pennsylvania line to Conneaut Harbor, 5 miles; branch to Conneaut Lake, 1.2 miles.

Salem & Washingtonville.—Track laid in 1892, Salem to Washingtonville, 7 miles.

Sandusky & Columbus Short Line.—Track laid in 1892, Bellevue to Columbus, 95 miles; branches, 2 miles.

Toledo & Ohio Central.—Surveyed, Columbus to Ridgeway, 46 miles. Ch. Engr., C. Buxton, Toledo.

Toledo, Walhounding Valley & Ohio.—Track laid in 1892, Coshocton to Loudonville, 45.6 miles. Surveyed, Coshocton to Powhattan, 85 miles. Ch. Engr., J. A. Hanlon, Coshocton.

Wabash.—Track laid in 1892, Montpelier to the Indiana line, 8.7 miles.

Wheeling & Lake Erie.—Surveyed, Martins Ferry to Altuaville, 3 miles.

Talah.—Track laid in 1892, 212.8 miles. In process of construction, 120 miles. Surveyed or under survey, 216 miles. Projects of some promise, 35 miles.

Michigan.

Au Sable & Northwestern.—Track laid in 1892, Twin Lakes Junc. to Twin Lakes, 31 miles.

Chicago & West Michigan.—Track laid in 1892, Alden to Charlevoix, 36.7 miles; Cherrie to Ironton, 4.2 miles; extension to Petoskey, 2 miles.

Chicago, Milwaukee & St. Paul.—Track laid in 1892, Milwaukee & Northern R. R., Ford Siding to Sidnaw, 45 miles. Surveyed, Port to Houghton, 35 miles.

Flint & Pere Marquette.—Track laid in 1892, Baubee Creek to Union Depot, 5.36 miles.

Frost.—Track laid in 1892, Kenton to Withey, 7.12 miles. Not a common carrier.

Grand Rapids & Indiana.—Track laid in 1892, Clarion to Bear Lake, 1.07 miles.

Grand River.—Track laid in 1892, Jenison to Blendon, 15 miles. Surveyed, between Grand Rapids and Grand Haven, 20 miles; Grand Rapids to Belding, 35 miles.

Iron Range & Huron Bay.—Track laid in 1892, Huron Bay to Champion, 35 miles. Surveyed, Champion to Negaunee, 19 miles.

Mancelona & Northwestern.—Located to be built in 1893, 2 miles. Pres., W. H. Thompson, Mancelona.

Manistee & Grand Rapids.—Track laid in 1892, extension to Chicago & West Michigan R. R., 3.92 miles; extension to Manistee & Northeastern R. R., 2.22 miles. Surveyed, Chic. & W. Mich. R. R. to East of Luther, 11 miles; Oak Park to Manistee River, 3.33 miles. Ch. Engr., E. W. Muenscher, Manistee.

Manistee & Northeastern.—Track laid in 1892, Cedar River to Traverse City, 15 miles; on branches 3 miles.

Michigan Central.—Track laid in 1892, Bay City belt line, 3 miles; extension to Lewiston, 6 miles.

Milwaukee, Lake Shore & Western.—Track laid in 1892, on Ontonagon River branches, 5.65 miles.

Osceola, Lake & Wexford.—Track laid in 1892, Olga to Hoxeville, 10 miles.

Total.—Track laid in 1892, 231.24 miles. Surveyed or under survey, 125 miles.

Indiana.

Bedford Belt.—Track laid in 1892, Bedford to Bluff Ridge and Salt Creek Junc., to Dark Hollow, 9 miles.

Chicago & South Bend.—Track laid in 1892, South Bend to Myler, 8 miles.

Chicago, Indianapolis & Chattanooga Southern.—Surveyed, Mitchell to Rockport, 85 miles. Ch. Engr., J. H. McCormick, Columbus.

Elgin, Joliet & Eastern.—Under construction, McCoal to Porter, 4.75 miles. Ch. Engr., S. H. Lee, Joliet.

Ft. Wayne, Terre Haute & Southwestern.—Partly graded, Carbon to Bainbridge, 18 miles. Gen. Man., E. P. Welch, Chicago, Ill.

Goshen Lateral.—Track laid in 1892, at Goshen, Ind., 1.5 miles. Surveyed, extension, 2.5 miles. Ch. Engr., C. L. Kinney, Goshen.

Indiana, Illinois & Iowa.—Surveyed, Knox to South Bend, 40 miles. Gen. Man., T. P. Shouts, Chicago.

Indianapolis, Logansport & Chicago.—Surveyed, Indianapolis to Logansport, 70.6 miles. Pres., E. N. Talbott, Logansport.

Louisville, Evansville & St. Louis.—Located, near Winslow to Augusta, 4 miles. Ch. Engr., T. A. Allen, Huntingburg.

Muncie Belt.—Under construction at Muncie, Ind., 10 miles. Two miles graded and one mile of track laid; work to be resumed in the spring. Ch. Engr., S. W. Hayer, Muncie.

Ohio & Mississippi.—Surveyed, Mitchell Hollow to Bedford, 3 miles.

Pennsylvania.—Track laid in 1892, State Line & Indiana R. R., 3.22 miles.

Wabash.—Track laid in 1892, Ohio line to Hammond, 139 miles.

Total.—Track laid in 1892, 160.7 miles. In process of construction, 50.75 miles. Surveyed, or under survey, 205 miles.

Illinois.

Atchison, Topeka & Santa Fe.—Track laid in 1892, Joliet to Patterson, 4.29 miles.

Centralia & Chester.—Track laid in 1892, Nashville to Hoyleton, 11 miles. Surveyed, Hoyleton to Centralia, 11 miles. Ch. Engr., H. W. Schmidt, Sparta.

Chicago & New Orleans.—Under contract, Altamont to Paducah, 130 miles. Contrs., Oliver Ferguson & Sons, Evansville, Ind. Engr., C. P. Moore, Farina.

Chicago Central.—Track laid in 1892, Ogden Ave., Chicago, to Blue Island, 15 miles; Blue Island to Harvey, 3.1 miles; East Chicago, east 2.8 miles.

Clayton & Pea Ridge.—Surveyed, Clayton to Huntsville, 12 miles. Pres., G. W. Montgomery; Secy., C. A. Wever, both of Clayton.

Illinois Central.—Track laid in 1892, Kensington to Blue Island, 3.85 miles.

Jacksonville Southeastern.—Track laid in 1892, Durley to Greenville, 3.92 miles. Partly graded, Havana to Rock Island, 107 miles.

La Salle & Bureau Co.—Track laid in 1892, at La Salle, 6.75 miles.

Peoria & Eastern.—Under construction, Danville west, 2 miles.

Peoria Belt.—Track laid in 1892, Bartlett toward Peoria, 1.3 miles.

St. Louis, Chicago & St. Paul.—Track laid in 1892, Laomi north 2 miles. Under construction, Laomi to Springfield, 12 miles; Alton to Kindar, 20 miles. Ch. Engr., E. M. Rice, Alton.

St. Louis Merchants' Bridge Terminal.—Track laid in 1892, on two extensions, 2 miles.

Wabash, Chester & Western.—Track laid in 1892, Tamaroa to Mt. Vernon, 22 miles.

Total.—Track laid in 1892, 78 miles. In process of construction, 271 miles. Surveyed or under survey, 23 miles.

Wisconsin.

Ahnapee & Western.—Track laid in 1892, Casco Junc. to Ahnapee, 14 miles. Under construction, Ahnapee to Sturgeon Bay, 20 miles. Pres., E. Decker, Ahnapee.

Chicago & Northwestern.—Under survey, Necedah to Princeton, 50 miles.

Chicago, Milwaukee & St. Paul.—Track laid in 1892, Wausaukee to Oconto Lumber Co.'s lands, 17 miles (reported as a logging road only); Lynn, north 2.75 miles.

Chippewa & Menominee.—Track laid in 1892, Johnson Lake to Deer Lake, 5.25 miles. Under construction, 3-mile extension. Secy., W. Irvine, Chippewa Falls.

Duluth, South Shore & Atlantic.—Track laid in 1892, Ruthmore to Atlantic Junc., 41.25 miles.

Goodyear, Millsville & Northern.—Track laid in 1892, McKenna toward Millston, 6 miles.

Kickapoo Valley & Northern.—Surveyed, Soldiers' Grove to Viola, 10 miles. Vice-Pres., E. T. Kidd, Prairie du Chien.

Minnesota & Wisconsin.—Track laid in 1892, Woodville to Emerald, 10.5 miles. Under contract, Emerald north, 16 miles.

Minneapolis, St. Paul & Sault Ste. Marie.—Track laid in 1892, Armstrong north, 3 miles.

Phillips & La Crosse.—Under contract, Phillips to Kennon, 15 miles. Pres., Geo. E. Anthony, Phillips; Ch. Engr., H. E. Clark, St. Paul, Minn.

Superior Belt & Terminal.—Track laid in 1892, St. Louis River to Allouez Bay, 12 miles.

Total.—Track laid in 1892, 111.75 miles. In process of construction, 54 miles. Surveyed or under survey, 60 miles.

Total, North Central States.—Track laid in 1892, 924.54 miles. In process of construction, 496 miles. Surveyed or under survey, 629 miles. Projects of some promise, 35 miles.

SOUTH ATLANTIC.

Virginia.

Abingdon Coal & Iron.—Graded, Abingdon to Damascus, 15 miles. Surveyed, Damascus to Mt. City, Tenn., 16 miles (Va. 4, Tenn. 12).

Buckingham.—Track laid in 1892, Arvonia south 8 miles. Under construction, 8 miles south of Arvonia to Rosney, 8 miles.

Norfolk & Western.—Track laid in 1892, Christiansburg Belt Line, 3.6 miles; Big Tom Branch, 4.6 miles; Russell Fork Branch, 2.8 miles; Norfolk Coal & Coke Co.'s Branch, 1.1 miles. Petter's Branch, 0.75 mile; Indian Camp Branch, 1.19 miles. Partly graded, Great Outburst to the North Carolina line, 20 miles.

Pennsylvania.—Track laid in 1892, Washington Southern Ry., St. Asaph St. Branch, 1.07 miles; Henry St. Branch, 1.33 miles; New York, Philadelphia & Norfolk R. R., Delmar, Del., to Cape Charles City, 0.54 mile.

Richmond & Chesapeake.—Located, Richmond to Wicomico, 50 miles.

Roanoke, Fincastle & Clifton Forge.—Partly graded, Fincastle to Cloverdale, 12 miles. Surveyed, between Roanoke and Eagle Rock, including above 12 miles, 35 miles. Pres., Chas. H. Vines, Fincastle. Ch. Engr., Jas. K. Brown, Roanoke.

Total.—Track laid in 1892, 25 miles. In process of construction, 72 miles. Surveyed or under survey, 73 miles.

West Virginia.

Baltimore & Ohio.—Under construction, Morgantown to Springfield, Pa., 20 miles (Pa. 9, W. Va. 11.7). Belt line at Fairmount, 6 miles. Contrs., T. J. Steers & Co. Surveyed, Cherry Run to Harper's Ferry, 32 miles.

Cairo & Kanawha Valley.—Track laid in 1892, 2 miles. Under construction, extension 5 miles. Pres., H. S. Wilson, Parkersburg.

Charleston, Clendennin & Sutton.—Track laid in 1892, Charleston to Fallen Rock, 15.5 miles. Graded, Fallen Rock to Clendennin, 5 miles. Surveyed, Clendennin to Sutton, 75 miles. Pres., F. W. Abney, Charleston.

Chesapeake & Ohio.—Track laid in 1892, Rush Run to mines, 3.8 miles. Partly graded, extension of Rush Run Branch, 7.7 miles. Under construction, Kenney's Creek to Withrow's Mill, 5 miles. Partly graded. Gauley to Twenty-mile Creek, 9 miles. Under contract, branch up Loup Creek, 10 miles.

Fairmount Belt Line.—Track laid in 1892, at Fairmount, 0.8 mile.

Huntington & Big Sandy.—Track laid in 1892, Vinson to Kenova, 3.1 miles; Guyandotte to Huntington, 3.4 miles.

Kanawha & Michigan.—Under construction, Malden to Gauley Bridge, 35 miles. Contrs., J. A. Casement & Co., Painesville, O.

Norfolk & Western.—Track laid in 1892, Boissevain to Hallsville, 113.5 miles; Kenova Belt, 1 mile; North Fork Branch, 1 mile.

Ohio River.—Track laid in 1892, Guyandotte to H. & B. S. Junc., 0.5 mile.

Pennsylvania.—Under construction, New Cumberland to Pennsylvania line, 13 miles.

Powellton & Pocahontas.—Surveyed, Powellton south, 5 miles.

Western Maryland.—Track laid in 1892, Maryland line to Cherry Run, 10.3 miles.

West Virginia & Pittsburg.—Track laid in 1892, Elk River to Camden, 32 miles; Newton to Pickens, 9 miles.

Wheeling & Connellsville.—Surveyed, Wheeling to Uniontown, Pa., 75 miles. (10 W. Va., 65 Pa.) Ch. Engr., Job. Abbott, 150 Broadway, New York, N. Y.

Total.—Track laid in 1892, 195 miles. In process of construction, 107 miles. Surveyed or under survey, 90 miles.

North Carolina.

Atlantic Coast Line.—Track laid in 1892, C. & R. Junc. to Washington, 25 miles; between Fayetteville and Rowland, 12.6 miles.

Carolina Mining, Manufacturing & Improvement Co.—Track laid in 1892, Sylvia to Webster, 4 miles.

East Carolina Land & Ry. Co.—Track laid in 1892, Jacksonville north, 6 miles. Under construction, 6 miles north of Jacksonville to New Berne, 31.4 miles. Ch. Engr., Foster B. Morse, Wilmington.

Glendon & Gulf.—Partly graded, Gulf up Deep River, 10 miles. Ch. Engr., Frank D. Jones, Gulf.

Laurel River & Hot Springs.—Track laid in 1892, at Hot Springs, 0.5 mile. Under construction, Hot Springs to Foster Creek, 25 miles. Ch. Engr., H. M. Ramseur, Hot Springs.

Linville Improvement Co.—Surveyed, Cranberry to Linville, 13 miles. Gen. Man., S. T. Kelsey, Linville.

Oxford & Coast Line.—Graded, Oxford to D. & N. R. R., 4.5 miles. Ch. Engr., Ashton H. Chapman, Oxford.

Raleigh & Western.—Under construction, Egypt to Ashboro, 45 miles. Ch. Engr., J. J. Sickles, Egypt.

Total.—Track laid in 1892, 48.1 miles. In process of construction, 116 miles. Surveyed or under survey, 13 miles.

South Carolina.

Atlantic Coast Line.—Track laid in 1892, Latta to Dunbar, 17 miles.

Branchville & Bowman.—Track laid in 1892, Sandy Run to Bowman, 2 miles.

Charleston, Sumter & Northern.—Track laid in 1892, Bennettsville to Gibson, 10.83 miles.

Lockhart Shoals.—Surveyed, Jonesville to Lockhart Shoals, 16 miles.

Pickens.—Graded, Easley to Pickens, 9 miles.

Total.—Track laid in 1892, 20.8 miles. In process of construction, 9 miles. Surveyed or under survey, 16 miles.

Georgia.

Boston & Albany.—Track laid in 1892, Hollis to Dot, 8 miles. Under construction, Dot to Moultrie, 9.5 miles. Supt., C. W. Pidcock, Round Lake.

Chickamauga & Durham.—Track laid in 1892, Chickamauga to Durham, 17.5 miles.

Florida Central & Peninsular. — Under contract, Savannah to Hart's Road, Fla., 114 miles. (Fla. 5, Ga. 109.) Contrs., Southern Supply Co., Atlanta.

Georgia, Carolina & Northern.—Track laid in 1892, Atlanta Belt line, 8.1 miles; extension to Atlanta, 21.6 miles.

Macon, Dublin & Savannah.—Track laid in 1892, extension into city of Macon, 2 miles. Projected, Dublin to Savannah, 110 miles. Gen. Man., Jas. T. Wright, Macon.

Middle Georgia & Atlantic.—Partly graded, Machen to Covington, 26 miles. Ch. Engr., Arthur Pew, Talbotton.

Millen & Southern.—Surveyed, Millen to Lyons, 20 miles. Pres., Loring R. Millen, 16 Beaver St., New York, N. Y.

Nashville, Chattanooga & St. Louis.—Track laid in 1892, Emmons to ore mines, 1.6 miles.

Oconee & Western.—Partly graded, extension to Dublin, 8.5 miles; Hawkinsville to Grovania, 13 miles.

Total.—Track laid in 1892, 58.8 miles. In process of construction, 66 miles. Surveyed or under survey, 20 miles. Projects of some promise, 110 miles.

Florida.

Arcadia, Gulf Coast & Lakeland.—Track laid in 1892, Braidentown to Sarasota, 11.5 miles. Surveyed, Lakeland to Braidentown, 67 miles. Ch. Engr., K. B. Harvey, Paunta Gorda.

Carrabelle, Tallahassee & Georgia.—Track laid in 1892, Ocklocknee River to Sopchoppy, 10 miles. Under contract, Sopchoppy to Tallahassee, 30 miles. Contrs., J. H. Davidson & Co., Thomasville. Gen. Man., A. O. Symington, Carrabelle.

Florida Central & Peninsular.—Track laid in 1892, Turkey Creek to phosphate mines, 5.1 miles.

Florida Midland.—Track laid in 1892, Kissimmee to Lake, 4 miles.

Gainesville, Rocky Pt. & Micanopy.—Partly graded, Gainesville to Micanopy, 12 miles. Pres., J. W. Carter, Gainesville.

Jacksonville, St. Augustine & Indian River.—Track laid in 1892, Daytona to Rockledge, 66.4 miles. Surveyed, Rockledge to Eau Gallie, 23 miles. Ch. Engr., Chas. O. Haines, Titusville.

Piedmont.—Track laid in 1892, Piedmont Junc. to Rossville, 2 miles.

South Florida.—Track laid in 1892, 3 miles north of Pemberton Ferry to Inverness, 17.3 miles. Extensions projected for construction in 1893. Mileage not given. Ch. Engr., T. L. Morton, Sanford.

Wekiva, Bronson & Northern.—Surveyed, Bronson to Trenton, 19.5 miles; Trenton to Suwannee River, 11.5 miles. Ch. Engr., Chas. P. Turner, Judson.

Winston & Bone Valley.—Track laid in 1892, Winston to Pebbledale, 16 miles; two branches, 2.75 miles.

Total.—Track laid in 1892, 135 miles. In process of construction, 47 miles. Surveyed or under survey, 121 miles.

Total, South Atlantic States.—Track laid in 1892, 491.7 miles. In process of construction, 417 miles. Surveyed or under survey, 333 miles. Projects of some promise, 110 miles.

SOUTH CENTRAL.

Kentucky.

Altamont & Manchester.—Track laid in 1892, Altamont to Lucell, 3 miles. Under construction, Lucell to Manchester, 23 miles. Treas., A. M. Crooke, Altamont.

Chesapeake & Ohio.—Track laid in 1892, extension to Richardson, 4.7 miles; Kinneconick Branch, 11.75 miles.

Jellico & Bird Eye.—Graded, Jellico to Bird Eye mines, 7.5 miles. Ch. Engr., W. C. Crozer, Knoxville.

Louisville & Nashville.—Under contract, Pineville up Clear Creek, 12 miles. Contrs., Jas. Coyne & Co., Louisville.

Louisville, St. Louis & Texas.—Under construction, Howard to South Louisville, 17.5 miles.

Louisville Terminal.—Track laid in 1892, at Louisville, 3 miles. Under construction, 6 miles. Contrs., Jas. Coyne & Co., Louisville.

Ohio Valley.—Track laid in 1892, Gracey to Hopkinsville, 10 miles.

Owensboro, Falls of Rough & Green River.—Track laid in 1892, Fordsville to Carters, 4 miles; Horse Branch to O'Laton, 6 miles.

West Virginia, Pineville & Tennessee.—Surveyed, Truxton to coal mine, 1 mile; junction Right and Left Forks of Straight Creek to coal mine, 6 miles. Pres., J. D. Blake, Pineville.

Winchester & Beattyville.—Track laid in 1892, Beattyville to Beattyville Junc., 5.6 miles; branch, 1.4 miles.

Total.—Track laid in 1892, 40.45 miles. In process of construction, 66 miles. Surveyed or under survey, 7 miles.

Tennessee.

Bristol Belt Line.—Track laid in 1892, at Bristol, 1 mile. Surveyed, Bristol to Blountville, 9 miles. Gen. Man., W. A. Sadleman, Bristol.

Bristol, Elizabethtown & North Carolina.—Track laid in 1892, Bristol to Elizabethtown, 22 miles. Surveyed, Elizabethtown to Mountain City, 33 miles. Ch. Engr., Geo. S. Bruce, Bristol.

Harriman Coal & Iron.—Track laid in 1892, Harriman to DeArmond, 4.4 miles. Partly graded, Harriman to Brushy Mt., 14 miles. Ch. Engr., J. A. Fairleigh, Harriman.

Holston Valley.—Under contract, Bluff City to Damascus, Va., 25 miles. Contrs., Smalling & Co., Watauga. Gen. Man., A. F. Arley, Bristol.

Louisville & Nashville.—Track laid in 1892, Marion to Van Leer, 7.1 miles.

Middle & East Tennessee.—Surveyed, Hartsville to Carthage, 16 miles. Gen. Man., J. C. Rodemer & Co., Gallatin.

Nashville & Knoxville.—Partly graded, Allgood to Standing Stone, 11 miles. Partly surveyed, Standing Stone to Glen Mary, 45 miles. Ch. Engr., R. J. Moscrip, Cookeville.

Nashville, Chattanooga & St. Louis.—Track laid in 1892, branch to Bon Air coal mines, 1 mile.

Paducah, Tennessee & Alabama.—Track laid in 1892, Hollow Rock to Lexington, 30.28 miles.

Unaka & Nolachuckey.—Surveyed, Morristown to Erwin, 75 miles. Ch. Engr., R. A. Bowie, Greenville.

Watauga Valley.—Track laid in 1892, South Watauga to tannery, 1.3 miles.

Total.—Track laid in 1892, 67 miles. In process of construction, 49 miles. Surveyed or under survey, 148 miles.

Alabama.

Alabama Grand Trunk.—Partly graded, Montgomery north, 12 miles. Pres., H. G. McCall, Montgomery.

Chattanooga Southern.—Under survey, Gadsden to Birmingham, 55 miles.

Escambia.—Surveyed, Steadham to Little River, 8 miles. Secy., J. J. Sullivan, Flomaton.

Gulf Red Cedar Co.—Graded, extension, 6 miles. Pres., W. H. Parrish, Greenville.

Gurley's & Paint Rock Valley.—Partly graded, Gurley's up Paint Rock Valley, 30 miles. Ch. Engr., W. H. Calhoun, Gurley's.

Isbell & Iron Mt.—Partly graded, Isbell to Iron Mt., 5.25 miles. Pres., C. H. Earth, Isbell.

Montgomery, Hayneville & Camden.—Partly graded, Camden northeast, 10 miles. Pres., Sol. D. Bloch; Ch. Engr., C. P. Rogers; both of Camden.

Nashville, Chattanooga & St. Louis.—Track laid in 1892, South Guntersville to Tennessee River, 3.5 miles; Huntsville to Hobbs Island, 15.5 miles.

Piedmont, Laney & Birmingham.—Track laid in 1892, extension to mines, 1 mile. Surveyed, Laney to Burke Iron Mt., 8 miles. T. S. McDaniel, Irondale.

Tredgar Mineral.—Track laid in 1892, at Jacksonville, 1 mile. Partly surveyed, Tredgar Junc. to Taff, 35 miles.

Total.—Track laid in 1892, 21 miles. In process of construction, 63 miles. Surveyed or under survey, 106 miles.

Mississippi.

Chickasayha & Jackson.—Track laid in 1892, Chickasayha toward Jackson, 8 miles. Under construction, extension, 7 miles. Ch. Engr., W. F. Lee, Pensacola, Fla.

Gulf & Ship Island.—Surveyed, Pontotoc to Houston, 25 miles. Pres., J. W. Fallsner, Oxford.

Mississippi Central Valley.—Under construction, Rosedale to Bogue Phalia, 6.5 miles. Pres., Chas. Scott, Rosedale.

Total.—Track laid in 1892, 8 miles. In process of construction, 13.5 miles. Surveyed or under survey, 20 miles.

Louisiana.

East Louisiana.—Track laid in 1892, extension to Mandeville, 11 miles.

Kansas City, Watkins & Gulf.—Track laid in 1892, Oakdale to Alexandria, 40 miles; Lake Charles station to Calcasieu River, 2 miles. Located, Bon Air to Gulf of Mexico, 25 miles. Ch. Engr., P. H. Philbrick, Lake Charles.

Louisiana Nickel Plate.—Track laid in 1892, Allendale to Hainsville, 4 miles. Under construction, Hainsville north, 3 miles. W. G. Wadley, Houghton.

Natchitoches.—Graded, Natchitoches to Grand Ecore, 5 miles. Pres., L. Caspar, Natchitoches.

New Orleans & Northwestern.—Track laid in 1892, Bastrop to Collins, 7 miles. Located Rayvill to Collins, 25 miles. Gen. Man., Wm. D. Jenkins, Natches.

Southern Pacific.—Track laid in 1892, New Iberia to Abbeville, 16.25 miles.

Total.—Track laid in 1892, 80 miles. In process of construction, 8 miles. Surveyed or under survey, 50 miles.

Total, South Central States.—Track laid in 1892, 225.45 miles. In process of construction, 299 miles. Surveyed or under survey, 331 miles.

SOUTHWESTERN.

Missouri.

Greenfield & Northern.—Track laid in 1892, Mt. Vernon to Aurora, 11.5 miles.

Kansas City, Nevada & Ft. Smith.—Track laid in 1892, Hume to Cambria, 17.6 miles. Under construction, Cambria to Pittsburg, Kan., 31 miles. Ch. Engr., J. C. Collins, Kansas City.

Kansas City, Osceola & Southern.—Track laid in 1892, Chicago & Alton R. R. to Kansas City Surburban Belt R. R., 0.94 mile.

Kansas City, Surburban Belt.—Track laid in 1892, Kaw River east, in Kansas City, 1.5 miles; Brush Creek to Ulysses, 0.75 mile. Under construction, Kaw River to Argentine, 4 miles.

Missouri, Kansas & Eastern.—Track laid in 1892, Hamburg to near New Jefferson, 89 miles. Under construction, extension to New Franklin, 45 miles. Ch. Engr., D. M. Wheeler, St. Charles.

Missouri Pacific.—Track laid in 1892, Webb City to Scotland, 4.82 miles.

Missouri Southeastern.—Track laid in 1892, Zeta to Aquilla, 3 miles. Graded, Aquilla to Bloomfield, 3.75 miles. Surveyed, Zeta east to Little River, 7 miles. Gen. Man., Geo. H. Crumb, Ardiola.

St. Louis & Hannibal.—Track laid in 1892, Rails Junc. to Perry, 18 miles; Oakwood to Hannibal, 3 miles.

St. Louis, Keokuk & Northwestern.—Track laid in 1892, Cuivre Junc. toward Bellefontaine Bluffs, 20 miles. Under construction, extension to St. Louis, 19 miles.

St. Louis Merchants' Bridge Terminal.—Track laid in city of St. Louis, 1 mile.

Total.—Track laid in 1892, 171.11 miles. In process of construction, 93 miles. Surveyed or under survey, 7 miles.

Arkansas.

Eureka Springs.—Surveyed, Eureka Springs to Harrison, 50 miles. Pres., Powell Clayton, Eureka Springs.

Kansas City, Arkansas & New Orleans.—Partly graded, Hazen south via Stuttgart, 45 miles. Pres., C. G. Stoddart, 18 Broadway, New York, N. Y.

Mississippi & Little Rock.—Located, Ross to Little Rock, 23 miles; Aurich to Duncan, 10 miles. Surveyed, Hot Springs to Mountain Valley, 13 miles.

North Arkansas.—Surveyed, Ravenden to Ravenden Springs, 9 miles. Secy., J. B. Duval, Ravenden Springs.

Pine Bluff & Eastern.—Track laid in 1892, extension to English, 2.6 miles. Under construction, English to Bayou Meto, 4 miles. Surveyed, Bayou Meto to St. Charles, 26 miles. Ch. Engr., J. J. Martin, Pine Bluff.

Southwest Arkansas & Indian Territory.—Track laid in 1892, Oklahoma to Antoine, 6 miles. Surveyed, Antoine to 6 miles northwest of Antioch, 12 miles.

Springfield, Yellville & White River.—Under construction Winnerva to Yellville, 18 miles. Ch. Engr., D. W. Pike, Kansas City, Mo.

Stuttgart & Arkansas River.—Track laid in 1892, De Witt to Leslie Center, 15 miles. Under construction, Leslie Center to Pendleton, 5 miles. Ch. Engr., H. B. Carter, Clarendon.

Texarkana & Ft. Smith.—Track laid in 1892, Ashdown to Wilton, 6 miles. Under survey, Wilton to Little River, 10 miles.

Ultima Thule, Arkadelphia & Mississippi River.—Track laid in 1892, Delark toward Milliville, 8 miles. Under construction, extension to Milliville, 18 miles. Ch. Engr., N. S. Woods, Arkadelphia.

Total.—Track laid in 1892, 37 miles. In process of construction, 90 miles. Surveyed or under survey, 153 miles.

Kansas.

Kansas City, Ft. Scott & Memphis.—Track laid in 1892, Wier City to Mackie, 1 mile.

Total.—Track laid in 1892, 1 mile. In process of construction, 9.66 miles.

Texas.

Austin & Northwestern.—Track laid in 1892, Fairland to Llano, 29.09 miles.

Chicago, Rock Island & Pacific.—Track laid in 1892, Red River to Bowie, 24 miles. Under survey, Bowie to Ft. Worth, 70 miles. Ch. Engr., R. W. Day, Topeka, Kan.

Ft. Worth & Rio Grande.—Surveyed, Brownwood to Brady, 44 miles.

Gulf, Newport & Northern.—Under construction, Alligator Head to Victoria, 50 miles.

Hearne & Brazos Valley.—Track laid in 1892, Mumford to Stone City, 8 miles.

Houston Belt & Magnolia Park.—Under construction, Magnolia Park to Harrisburg, 1.3 miles.

La Porte, Houston & Northern.—Graded, La Porte to Harrisburg, 16.75 miles. Under construction, La Porte to Clear Creek, 8 miles. Ch. Engr., C. G. Woodbridge.

Lufkin South & Southwestern.—Projected, Lufkin to Rockland, 30 miles. Pres., E. J. Mantooth, Lufkin.

Missouri, Kansas & Texas.—Track laid in 1892, Smithville to Lockhart, 37.5 miles; Sherman south, 1 mile; Hillsboro Junc. to Hillsboro, 1 mile; Boggy Tank east, 57 miles. Tracklaying in progress, extension to Houston, 19 miles. Under construction, Denison to new yards, 5 miles.

North Galveston, Houston & Kansas City.—Track laid in 1892, Virginia Point to North Galveston, 16.7 miles. Located, North Galveston to Clear Creek, 7 miles. Gen. Man., J. F. Nadeau, North Galveston.

Pan American.—Track laid in 1892, Victoria to Guadaloupe River, 10 miles.

Paris, Marshall & Sabine Pass.—Track laid in 1892, Montvale Springs to Harlton, 3 miles.

Texas & Sabine Valley.—Projected. Carthage to Center, 30 miles. Pres., Edw. S. Larcher, 15 Wall St., New York, N. Y.

Texas Central.—Under survey, Ross to Waco, 10 miles.

Texas, Louisiana & Eastern.—Track laid in 1892. Caney Creek to Cleveland, 14 miles.

Velasco Terminal.—Track laid in 1892, between Velasco and Chenango Junc., 15 miles.

Total.—Track laid in 1892, 216.29 miles. In process of construction, 107 miles. Surveyed or under survey, 124 miles. Projects of some promise, 60 miles.

Colorado.

Colorado Midland.—Under construction, extension to Cripple Creek mines, with branches, 31 miles.

Crystal River.—Track laid in 1892, Carbondale to Thompson Creek, 5 miles. Under construction, Thompson Creek to Coal Creek, 12 miles; Coal Creek to Coal Basin, 12 miles. Surveyed, Coal Creek to Crystal, 22 miles. Gen. Man., J. A. Kibler, 710 Boston Building, Denver.

Denver & Rio Grande.—Under construction, Crested Butte to coal mines, 10.76 miles.

Rio Grande Southern.—Track laid in 1892, Ute Spur, 2 miles; branch to Porter's mines, 0.75 mile; other branches, 4 miles. Projected, Dolores or Mancos to Bluff, Utah, 55 miles.

Union Pacific.—Track laid in 1892, Victor Junc. to Acme Junc., 7.55 miles; Acme Junc. to Aquila, 2.51 miles; extension Gray Creek Branch, 2.27 miles; Louisville to Allen Bond mine, 3.22 miles.

Total.—Track laid in 1892, 27.3 miles. In process of construction, 66 miles. Surveyed or under survey, 22 miles. Projects of some promise, 23 miles.

New Mexico.

Atchison, Topeka & Santa Fe.—Track laid in 1893, Waldo to coal mines, 5.75 miles.

Union Pacific.—Track laid in 1892, on Red River branch, 1 mile. Projected farther extension, 10 miles.

Total.—Track laid in 1892, 6.75 miles. Projects of some promise, 10 miles.

Indian Territory.

Chicago, Rock Island & Pacific.—Track laid in 1892, Minco to Red River, 104 miles.

Choctaw Coal & Ry. Co.—Track laid in 1892, extension to Oklahoma City, 12 miles. Surveyed, South McAlester to Oklahoma City, 125 miles. Asst. Engr., H. W. Cox, South McAlester.

Total.—Track laid in 1892, 116 miles. Surveyed or under survey, 125 miles.

Total, Southwestern States.—Track laid in 1892, 574.45 miles. In process of construction, 366 miles. Surveyed or under survey, 451 miles. Projects of some promise, 93 miles.

NORTHWESTERN.

Iowa.

Burlington, Cedar Rapids & Northern.—Track laid in 1892, Forest City to Armstrong, 46.5 miles.

Chicago, Ft. Madison & Des Moines.—Track laid in 1892, Libertyville to Ottumwa, 21.5 miles.

Southern Iowa.—Track laid in 1892, Pekay Junc. to Pekay, 2.5 miles.

Total.—Track laid in 1892, 70.5 miles.

Minnesota.

Brainard & Northern Minnesota.—Track laid in 1892, Brainard north, 40 miles. Located, extension to Leech Lake, 46 miles. Pres., John S. Pillsbury; Gen. Man., Ray W. Jones; both of Minneapolis.

Burlington, Cedar Rapids & Northern.—Track laid in 1892, North Sioux Falls to Jasper, 3.77 miles.

Cloquet Lumber Co.—Track laid in 1892, extension, 7 miles.

Duluth & Iron Range.—Track laid in 1892, Allen Junc. to Biwabik, 15.5 miles; McKinley Junc. to McKinley, 3.6 miles. Under construction, McKinley to Virginia City, 10 miles. Contrs., Winston Bros., Minneapolis. Surveyed, branch west to the Mesaba Range, 60 miles. Ch. Engr., R. Angst, Duluth.

Duluth & Winnipeg.—Surveyed, Grand Rapids to Diamond mines, 10 miles.

Duluth, Mesaba & Northern.—Track laid in 1892, Stoney Brook to Mountain iron mines, 48.5 miles; Ore Junc. to Virginia City, 7 miles; Iron Junc. to Biwabik, 15.5 miles. Located, Duluth to 5 miles north of Stoney Brook, 27 miles. Ch. Engr., C. H. Martz, Duluth.

Duluth, Mississippi & Northern.—Track laid in 1892, Swan River north, 16 miles; branch, 6 miles. Under contract, extension north, 27 miles. Surveyed, several logging branches. Ch. Engr., W. A. Dafter, Swan River.

Duluth, Red Wing & Southern.—Track laid in 1892, on three branches, 3.53 miles.

Duluth Transfer.—Track laid in 1892, in city of Duluth, 5.5 miles. Under contract and surveyed, extensions aggregating 15.5 miles.

Great Northern.—Track laid in 1892, St. Hilaire to Thief River Falls, 7.5 miles; St. Hilaire to Red Lake Falls, 14.25 miles.

Mankato & Northeastern.—Surveyed, Mankato to Farmington, 50 miles. Ch. Engr., F. D. Woodbury, Mankato.

Port Arthur, Duluth & Western.—Track laid in 1892, International line to Gunflint iron mine, 6 miles.

Total.—Track laid in 1892, 109.7 miles. In process of construction, 37 miles. Surveyed or under survey, 14 miles.

Nebraska.

Burlington & Missouri River.—Track laid in 1892, Hamlet to Imperial, 22.8 miles.

Chicago & Northwestern.—Surveyed, Ponca to Newcastle, 14 miles.

Chicago, Rock Island & Pacific.—Track laid in 1892, Lincoln—Jansen extension, 30 miles. Track laid in 1893, Lincoln—Jansen extension, 23 miles.

Yankton, Norfolk & Southwestern.—Graded, Yankton, S. Dak., to Osmond, 45 miles. Under construction, Osmond to Norfolk, 19 miles. Ch. Engr., A. K. Nash, Yankton, S. Dak.

Total.—Track laid in 1892, 52.8 miles. In process of construction, 87 miles. Projects of some promise, 14 miles.

South Dakota.

Burlington & Missouri River.—Track laid in 1892, branches to Hill City and Ruby Basin, 8 miles. Under contract, Portland to Spearfish, 28 miles. Contrs., Kilpatrick Bros. & Collins.

Dakota, Wyoming & Missouri River.—Track laid in 1892, Rapid City west, 5.5 miles. Partly graded, between Rapid City and Mystic, 27.5 miles. Pres., Wm. T. Coal, Rapid City.

Duluth, Pierre & Black Hills.—Under contract, Pierre to Aberdeen, 130 miles. Ch. Engr., B. P. Tilden, Aberdeen.

Sioux Falls, Yankton & Southwestern.—Under construction, Sioux Falls to Yankton, 60 miles. Ch. Engr., W. H. Knowlton, Sioux Falls.

Total.—Track laid in 1892, 13.5 miles. In process of construction, 245 miles.

North Dakota.

Minneapolis, St. Paul & Sault Ste. Marie.—Track laid in 1892, Merricourt to Keeler, 12.25 miles; Valley City to Cathay, 80.25 miles. Under contract, Cathay to the International line, 180 miles. Ch. Engr., W. W. Rich, Minneapolis.

Total.—Track laid in 1892, 92.5 miles. In process of construction, 20 miles.

Wyoming.

Burlington & Missouri River.—Track laid in 1892. Gillette to Sheridan, 105 miles. Graded, Sheridan to Langue River, 10 miles. A further extension of this line has been partly surveyed, but no definite information can be obtained in regard to the commencement of work.

Total.—Track laid in 1892, 105 miles. In process of construction, 10 miles.

Montana.

Butte, Anaconda & Pacific.—Under construction, Butte to Anaconda, 20 miles. Ch. Engr., T. W. C. Whyte, Anaconda.

Great Northern.—Track laid in 1892, branches near Butte City, 4.9 miles; Kalispell to the Idaho line, 122.4 miles.

Total.—Track laid in 1892, 127.3 miles. In process of construction, 20 miles.

Total Northwestern States.—Track laid in 1892, 661.3 miles. In process of construction, 198.5 miles. Surveyed or under survey, 28 miles.

PACIFIC.

California.

Arcata & Mad River.—Track laid in 1892, Riverside to Mad River, 2.5 miles.

California & Nevada.—Under construction, extension east, 5 miles. Ch. Engr., C. Bendeke, Oakland.

Los Angeles Terminal.—Projected, Glendale to Chatsworth, 25 miles. Gen. Man., T. B. Burnette, Los Angeles.

San Francisco & North Pacific.—Track laid in 1892, extension near Greenville, 1.93 miles.

Southern Pacific.—Track laid in 1892, Collis to Fresno, 15.2 miles; Bakersfield to Asphalto, 47.4 miles; Redlands to Crafton, 5.6 miles; other branches, 6.53 miles. Under construction. Santa Margarita to San Luis Obispo, 16 miles. Projected, Colton to Riverside, 2.5 miles.

Total.—Track laid in 1892, 79.16 miles. In process of construction, 21 miles. Projects of some promise, 50 miles.

Oregon.

Astoria & Portland.—Partly graded, Astoria south, 17 miles. Offices at Astoria.

Coos Bay, Roseburg & Eastern.—Track laid in 1892, Dunhams to Coquille River, 5.5 miles. Surveyed Coquille River to Roseburg, 71 miles. Secy., W. E. Baines, Marshfield.

Portland & Mt. Scott.—Track laid in 1892, Mt. Tabor northeast, 4 miles.

Total.—Track laid in 1892, 9.5 miles. In process of construction, 17 miles. Surveyed or under survey, 71 miles.

Washington.

Bellingham Bay & Eastern.—Track laid in 1892, New Whatcom toward Lake Whatcom, 3 miles. Surveyed, extension, 4 miles. Ch. Engr., J. J. Donovan, Fairhaven.

Columbia & Puget Sound. Track laid in 1892, Maple Valley to Maple Leaf, 9 miles.

Columbia Ry. & Nav. Co.—Under contract, Columbus to Crates Pt., 22 miles. Contrs., McKinzie + Glenn, Spokane. Ch. Engr., Emery Oliver, The Dalles.

Everett & Monte Christo.—Track laid in 1892, Lowell to Seattle & Montana Ry., 5 miles; Hartford Junc. to Stillaguamish Canyon, 10 miles. Under construction, Stillaguamish Canyon to Monte Christo, 32.5 miles. Ch. Engr., S. B. Fisher, Snohomish.

Great Northern.—Track laid in 1892, between Idaho line and Lowell, 350.9 miles.

Northern Pacific.—Track laid in 1892, extension of branch to South Bend, 37.5 miles.

Portland & Puget Sound.—Partly graded, Portland, Ore., to Seattle, 185 miles.

Shelton Southwestern.—Track laid in 1892, 3 miles. Under construction, extension 6 miles. Secy., E. E. Crowell, Shelton.

Spokane Falls & Northern.—Track laid in 1892. Little Dalles to Northport, 3.5 miles. Under construction, Northport to the International line, 10 miles. Pres., D. C. Corbin, Spokane.

Washington Southern.—Track laid in 1892, 3.5 miles.

Total.—Track laid in 1892, 425.4 miles. In process of construction, 255.5 miles. Surveyed or under survey, 4 miles.

Arizona.

Santa Fe, Prescott & Phoenix.—Track laid in 1892, Ash Fork to Rock Butte Station, 18 miles. Under contract, Rock Butte Station to Prescott, 42 miles. Ch. Engr., G. W. Vaughn, Prescott.

Total.—Track laid in 1892, 18 miles. In process of construction, 42 miles.

Utah.

Great Salt Lake & Hot Springs.—Track laid in 1892, Stockdale to Simkins, 2.5 miles; Hot Springs to Bountiful, 6 miles. Under contract, Bountiful to Coalville, 52 miles. Gen. Man., S. Bamberger, Salt Lake City.

Rio Grande Western.—Track laid in 1892, Eureka to Mammoth Mills, 7 miles.

Saltair.—Track laid in 1892, Salt Lake City to Saltair, 14 miles.

Total.—Track laid in 1892, 29.5 miles. In process of construction, 52 miles. Projects of some promise, 22 miles.

Idaho.

Great Northern.—Track laid in 1892, Montana line to Washington line, 82.7 miles.

Total.—Track laid in 1892, 82.7 miles.

Total, Pacific States.—Track laid in 1892, 644.26 miles. In process of construction, 387 miles. Surveyed or under survey, 75 miles. Projects of some promise.

CANADA.

Ontario, Quebec and Eastern Provinces.

Baie des Chaleurs.—Projected, Cascapedia, east 20 miles. Ch. Engr., A. L. Light, Quebec, P. Q.

Bay of Quinte.—Under construction, Harrowsmith to Sydenham, Ont., 5 miles. Ch. Engr., M. J. Butler, Deseronto, Ont.

Grand Trunk.—Under contract, Glencoe to Kingscourt, Ont., 22 miles. Ch. Engr., Jas. Hobson, Hamilton, Ont.

Irondale, Bancroft & Ottawa.—Graded, Irondale toward Bancroft, Ont., 10 miles.

Lake Erie & Detroit River.—Track laid in 1892, Leamington to Merlin, 23 miles. Projected, Merlin to Blenheim, Ont., 13 miles.

Montreal & Western.—Partly graded, extension toward St. Agathe, 10 miles.

Orford Mt.—Track laid in 1892, extension to Kingsbury, P. Q., 16 miles.

Ottawa & Gatineau Valley.—Track laid in 1892, 20th mile north of Hull, Ont., to Kazabazua, Ont., 20 miles. Located, Kazabazua to Le Desert, 45 miles.

Ottawa, Arnprior & Parry Sound.—Graded, Ottawa to Arnprior, Ont., 25 miles. Ch. Engr., S. B. Poulin, Emsdale, Ont.

Port Arthur, Duluth & Western.—Track laid in 1892, extension to International line, 15½ miles.

Quebec & Lake St. John.—Track laid in 1892, Chambourd Junc. east 30 miles. Partly graded, 30th mile east of Chambourd Junc. to Chicoutimi, Que., 21 miles. Ch. Engr., E. A. Hoare, Quebec, P. Q.

Quebec, Montmorencey & Charlevoix.—Track laid in 1892, St. Anne's to Grand Riviere, 3 miles. Partly graded, extension toward Cape Tourmente, 10 miles. Ch. Engr., E. A. Hoare, Quebec, P. Q.

Tobique Valley.—Track laid in 1892, 14th mile east of Perth Center, east 10 miles. Partly graded, 24th mile east of Perth Center to Plaster Rock, N. S., 4 miles. Contrs., Lawlor, Connor & Co., of St. John, N. B.

United Counties.—Track laid in 1892, Ste. Angele to Ste. Hyacinth, P. Q., 20 miles.

Total.—Track laid in 1892, 137.5 miles. In process of construction, 107 miles. Surveyed or under survey, 45 miles. Projects of some promise, 33 miles.

Manitoba and Western Provinces.

Burrard Inlet & Fraser Valley.—Surveyed, Sumas, Wash., to Vancouver, B. C., 47 miles. Pres., C. D. Rand, Vancouver, B. C.

Calgary & Edmonton.—Track laid in 1892, Mosquito Creek to Ft. McLeod, N. W. T., 51 miles.

Canadian Pacific.—Track laid in 1892, Monteith to Pipestone, 31.5 miles; Deloraine to Napinka, Man., 17.8 miles; Nesbitt to Souris, Man., 18.5 miles; Oxbow to Estevan, N. W. T., 38.5 miles. Partly graded, Pasqua, N. W. T., to International line, 161 miles.

Spokane Falls & Northern.—Surveyed, International line to Nelson, B. C., 60 miles. (See Washington.)

Total.—Track laid in 1892, 157.3 miles. In process of construction, 161 miles. Surveyed or under survey, 107 miles.

THE NEW BRAKE AND COUPLER ACT.

On February 27, the House of Representatives, under suspension of the rules, passed by a vote of 184 to 85 a bill of greater importance to the railway companies than any national legislation since the Interstate Commerce law. The full text of the bill is given below. That it will receive President Harrison's signature hardly admits of doubt, as he has repeatedly urged the attention of Congress to this subject in his messages, and recommended legislation upon it. We have commented on the bill in our editorial columns.

From and after the 1st day of January, 1898, it shall be unlawful for any common carrier engaged in interstate commerce by railroad to use on its line any locomotive engine in moving interstate traffic not equipped with a power driving wheel brake and appliances for operating the train-brake system, or to run any train in such traffic after said date that has not a sufficient number of cars in it so equipped with power or train brakes that the engineer on the locomotive drawing such train can control its speed without requiring brakemen to use the common hand brake for that purpose.

Sec. 2.—That on and after the 1st day of January, 1898, it shall be unlawful for any such common carrier to haul or permit to be hauled or used on its line any car used in moving interstate traffic not equipped with couplers coupling automatically by impact, and which can be uncoupled without the necessity of men going between the ends of the cars.

Sec. 3.—That when any person, firm, company, or corporation engaged in interstate commerce by railroad

shall have equipped a sufficient number of its cars so as to comply with the provisions of Section 1 of this act, it may lawfully refuse to receive from connecting lines of road or shippers any cars not equipped sufficiently, in accordance with the first section of this act, with such power or train brakes as will work and readily interchange with the brakes in use on its own cars, as required by this act.

Sec. 4.—That from and after the 1st day of July, 1895, until otherwise ordered by the Interstate Commerce Commission, it shall be unlawful for any railroad company to use any car in interstate commerce that is not provided with secure grab irons or handholds on the ends and sides of each car for greater security to men in coupling and uncoupling cars.

Sec. 5.—That within 90 days from the passage of this act the American Railway Association is authorized hereby to designate to the Interstate Commerce Commission the standard height of drawbars for freight cars, measured perpendicular from the level of the tops of the rails to the centers of the drawbars, for each of the several gages of railroads in use in the United States and shall fix a minimum variation from such standard height to be allowed between the drawbars of empty and loaded cars. Upon their determination being certified to the Interstate Commerce Commission, said commission shall at once give notice of the standard fixed upon to all common carriers, owners or lessees engaged in interstate commerce in the United States by such means as the Commission may deem proper. But should said Association fail to determine a standard as above provided, it shall be the duty of the Interstate Commerce Commission to do so, before July 1, 1894, and immediately to give notice thereof as aforesaid. And after July 1, 1895, no cars, either loaded or unloaded, shall be used in interstate traffic which do not comply with the standard above provided for.

Sec. 6.—That any such common carrier using any locomotive engine, running any train, or hauling or permitting to be hauled or used on its line any car in violation of any of the provisions of this act, shall be liable to a penalty of $100 for each and every such violation, to be recovered in a suit or suits to be brought by the United States district attorney in the district court of the United States having jurisdiction in the locality where such violation shall have been committed, and it shall be the duty of such district attorney to bring such suits upon duly verified information being lodged with him of such violation having occurred. And it shall also be the duty of the Interstate Commerce Commission to lodge with the proper district attorneys information of any such violations as may come to its knowledge: Provided, that nothing in this act contained shall apply to trains composed of four-wheel cars or to locomotives used in hauling such trains.

Sec. 7.—That the Interstate Commerce Commission may, from time to time, upon full hearing and for good cause, extend the period within which any common carrier shall comply with the provisions of this act.

Sec. 8.—That any employee of any such common carrier who may be injured by any locomotive, car, or train, contrary to the provisions of this act, shall not be deemed thereby to have assumed the risk thereby occasioned, although continuing in the employment of such carrier after the unlawful use of such locomotive, car, or train had been brought to his knowledge.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago.—Existing Roads.

PENNSYLVANIA.—Surveys are again reported to be in progress on the proposed line from Fairchance, Pa., to Morgantown, W. Va., paralleling the line now being constructed by the Baltimore & Ohio R. R. between those places.

OHIO & MISSISSIPPI.—The people of Greensburg, Ind., and vicinity are making efforts to secure the construction of a railway from Greensburg to Osgood, Ind., about 21 miles.

PHILADELPHIA & READING.—It is stated that this company intends to construct a 5-mile line from its Clark's Valley extension to the Williams Valley R. R. to carry lumber to the Lykens Valley and Larberry collieries.

KINGSTON, NAPANEE & WESTERN.—This company is now constructing a line from Harrowsmith to Lake Sydenham, Ont., 10 miles.

DUNKIRK, ALLEGHENY & PITTSBURG.—The construction of a short branch from Moore Station to Point Chautauqua, N. Y., is under consideration.

FINDLAY, FT. WAYNE & WESTERN.—Surveys are now in progress for the eastern extension from Findlay to New London, O.

Projects and Surveys.

EBENSBURG & BLACK LICK.—This company, whose incorporation was noted in our issue of Jan. 26, 1893, is reported to have let the contract for building its line from Ebensburg, Pa., to a connection with the Indiana Branch of the Pennsylvania R. R., about 35 miles, to Chas. MacFadden.

CENTRAL R. R. OF PENNSYLVANIA.—This company, which proposes to build a railway from Steelton to Middletown, Pa., has elected the following officers: Pres., W. H. Ulrich, Hummelstown; Secy., John F. Rohrer, and Treas., E. M. Hoffer, Hummelstown.

PRESQUE ISLE & ISHPEMING.—This company has been chartered in Michigan to build a railway from Presque Isle Harbor through Ishpeming and Negaunee, 17 miles, and contracts for its construction will soon be let. Geo. Hayden, of Ishpeming, Mich., is interested.

LANCASTER & NORTHERN.—Chartered in Ohio to build a railway from Lancaster to Thurston, O., 10 miles. Among the incorporators are: H. C. Drinkle, Thos. K. Work, S. L. Johnson, John N. Wolfe and others.

NORTH BEND & KETTLE CREEK.—Chartered in Pennsylvania to build a railway from North Bend, Clinton Co., to Stone House, Potter Co., 15 miles. Pres., F. A. Blackwell, Driftwood, Pa.

Southern.—Existing Roads.

HOLSTON VALLEY.—Gen. Man., A. F. Willey, Bristol, Tenn., writes that the contract for building the roads from Bristol, Tenn., to Halston Mt., and thence through timber lands, about 30 miles, has been let to A. T. Smalling & Co., of Bristol, Tenn., who have begun work. The grades and surveys will be light and there will be but one bridge of any size. This will be 400 ft. long and will cross the Holston River. The road is being built by the Willey Broom & Lumber Co., of Bluff City, Tenn., and is to be completed by Jan. 1, 1894.

MOBILE & BIRMINGHAM.—It is stated that this company will build an extension into Mobile, and add materially to its coaling facilities. It will also construct yards in the city.

Projects and Surveys.

NORTH CAROLINA.—Burlington, N. C.—The Burlington & Southwestern R. R. Co., lately mentioned, has obtained its charter from the legislature. The company is authorized to build a railroad from some point on the North Carolina R. R. in Alamance Co. to some point on the Cape Fear & Yadkin Valley R. R. in the counties of Guilford, Randolph or Chatham, and may extend its road toward the North Carolina-Virginia line and toward the North Carolina-South Carolina line. The incorporators are: W. L. Holt, C. E. McLean, C. C. Townsend, J. H. Holt, Jr., J. W. Menefee, E. S. Parker, J. A. Turrentine, J. D. Kernodle, J. R. Ireland, R. A. Freeman, M. B. Wharton, L. A. Williamson and J. L. Scott, Jr. The authorized capital stock is $500,000.——The Aberdeen & West End Ry. Co. has applied to the legislature for authority to construct two branches. The company at present operates a 25-mile road from Aberdeen to Candor, N. C.——The following companies have applied to the legislature for charters: Charlotte, Troy & Gelford R. R. Co.; Polk Co. R. R. Co.; Columbia, Charlotte & Winston R. R. Co.; Durham & Silver R. R. Co.——The Blowing Rock & Lenoir R. R. Co., which has applied to the legislature for a charter, proposes to build a railway from Blowing Rock to Lenoir, N. C.——The Durham & Charlotte Ry. Co., lately mentioned as applying to the legislature for a charter, intends building a railway through the counties of Durham, Chatham, Moore, Montgomery, Stanley, Cabarrus and Mecklenburg, with privilege of building branches of not over 30 miles in length. The incorporators are: J. S. Carr, W. M. Morgan, W. A. Guthrie and T. L. Peay.——The Catawba Toll Bridge R. R. Co. is applying to the legislature for a charter. A. A. Shuford, of Hickory, N. C., is interested.

POINT PLEASANT, BUCKHANNON & TYGARTS' VALLEY.—This company has completed its organization by electing the following officers: Pres., J. W. Heavner; Vice-Pres., J. H. Hanson, Secy., W. G. L. Lathus.

Northwest.—Existing Roads.

CHICAGO & EASTERN ILLINOIS.—Arrangements have been completed for the construction of a line from Rossville to Sidell, Ill.

CHICAGO & NORTHWESTERN.—A press dispatch from Chicago says: "It is announced that the Chicago & Northwestern Ry. will elevate all its tracks within the limits of Chicago, at an expense of $24,000,000. The plans provide for the elevation of 27 miles of first and second track and 143 miles of side track. The company estimates that the interest on the $24,000,000 will be less than the amount it is now compelled to pay annually on account of litigation and judgments arising from deaths and personal injury cases, due for the most part to the grade crossings."

PHILLIPS & LA CROSSE.—Pres., Geo. E. Anthony, Phillips, Wis., writes that this line will be built from Phillips to Kennan, Wis., 16 miles, this year.

Projects and Surveys.

HIGHLAND & MINERAL POINT.—Chartered in Wisconsin to build a railway from Highland to Mineral Point, Wis. Among the incorporators are: Rich. Kennedy, Michael Lynch, J. M. Sands and others.

MUSCATINE NORTH & SOUTH.—Chartered in Iowa to build a railroad between Muscatine, Ia., and Chicago or some point connecting with a Chicago line and from Muscatine west to the Missouri River.

Southwest.—Existing Roads.

AUSTIN & NORTHWESTERN.—An offer has been made to extend this road from Burnet to Lampasas, Tex., if a sufficient bonus is raised. It is thought that the money can be secured.

Projects and Surveys.

PORTLAND, GULF & MONTEREY.—A press dispatch says that this company, which proposes to build a railway from Portland, Tex., to Monterey, Mex., has purchased a large quantity of material, and the work of grading has actively begun. The line will pass through Nueces and Cameron counties, in Texas, traversing a rich agricultural and stock-raising country. The Rio Grande River will be crossed at Brownsville, and from that point the route, as surveyed, runs in almost a direct line to Monterey, Mex., passing through the states of Tamaulipas and Nueces Leon. The proposed line, when completed, will shorten the distance between St. Louis and Eastern points and the City of Mexico fully 200 miles.

HELENA & ST. FRANCIS RIVER.—A railway is to be constructed from Helena, Ark., to the mouth of the St. Francis River, a distance of 6 miles, to open up the timber lands of the St. Francis Basin.

SPRINGFIELD, SEDALIA, MARSHALL & NORTHERN.—An official of this company is reported as saying that construction on its proposed line from Springfield, Mo., north, would begin by April 1.

LA FAYETTE, VERMILION & GULF.—T. H. Leslie, of Stuttgart, Ark., has offered to build a railway from Abbeville to La Fayette, to be known as the La Fayette, Vermilion & Gulf, and to give a bonus of $25,000 to secure the establishment of a large factory in Abbeville, in consideration of the voting of a five-mill tax by the town of Abbeville, and a two-mill tax by the parish of Vermilion, for a period of 10 years. The citizens seem favorably impressed with the proposition.

Rocky Mountain and Pacific.—Existing Roads.

SOUTHERN PACIFIC.—Active progress is being made on the 16-mile extension from Santa Margarita to San Luis Obispo. About 1,000 men are now at work, and tracklaying has been commenced.

BUTTE, ANACONDA & PACIFIC.—Rapid progress is being made on the grading of this line from Butte City to Anaconda, Mont., 20 miles.

Projects and Surveys.

TRINIDAD, SAN LUIS VALLEY & PACIFIC.—The Denver "News," of Feb. 15, says: "The stockholders and directors of the Trinidad, San Luis Valley & Pacific Ry. met yesterday, and elected the following officers: Pres., David Gottlieb, of Trinidad; Vice-Pres., Fred Walsen, of Denver; Secy., A. C. McChesney, of Trinidad; Treas., Frank A. Burnell, of Denver; Chief Engr., John E. Mahon. The following Executive Board was also chosen: E. B. Sapris, John Grass, Casimero Barela and R. L. Wootton, Jr., of Trinidad, and Fred Walsen, of Denver. The road is announced as being entirely independent of existing lines, and is the outgrowth of years of effort at Trinidad. It will run up the Purgatoire River from Trinidad and across Costilla Pass into the San Luis Valley. From the Pass it will follow Costilla Creek to a point at or near Costilla, where it is to radiate in several lines. One will run to Taos, and thence across to Durango. Another will run to Saguache and across Cochetopa Pass to the Gunnison region. A branch will reach Alamosa, Del Norte and Creede, with a spur up the headwaters of the Rio Grande, if thought desirable. From Taos it is a comparatively short distance to Las Vegas, and the South, even El Paso, could thence be easily reached. The contract has been let to De Remer and others for the construction of the first 100 miles of the road. This will bring the line into the San Luis Valley, a distance of 82 miles, and will build a branch from the junction of Costilla and Apache creeks, up the latter to Elizabethtown, about 18 miles. Construction is to commence as soon as the snow goes off. All the surveys have been completed. It is claimed that not only going over Costilla Pass into the valley, but also in going over Cochetopa to the Gunnison, and going further west from Durango, if desired, a grade of not over 2% can be secured. The other roads crossing the great divide operate on a 4%-grade. The region which will be penetrated is known to be very rich in coal, minerals of all kinds and timber, and the projectors of the road say they have ample means to carry out their plans."

ELECTRIC RAILWAYS.

MARLBORO, MASS.—The State Central Street Ry. Co. proposes to build a line to Worcester and Northboro, with branches to other places. B. W. Potter, of Worcester, is interested.

GREENPORT, N. Y.—An electric railway to Orient, L. I., is projected, and it is proposed to increase the capital stock of the Greenport Electric Light & Power Co., to build the road and furnish the power.

JERSEY CITY, N. J.—The North Hudson Ry. Co. has applied for power to build extensions as electric roads. Mr. Charles Brush is the engineer.

RAHWAY, N. J.—Rahway Electric Street Ry. Co.; $25,000; to build to Woodbridge; C. W. Boynton, Woodbridge, N. J., and H. G. Walcott, Fishkill, N. Y.

PHILADELPHIA, PA.—Interstate Traction Co., to build to Gettysburg; $60,000, with $30,000 paid in; J. B. Reilly, P. McManus and Irwin T. Reiter.

SCRANTON, PA.—Jessup Rapid Transit Co.; $24,000, with $8,000 paid in; Pres., John J. Sweeney.—Scranton & Carbondale Traction Co.; $100,000, with $20,000 paid in; Pres., Alfred N. Chandler.

VILLA NOVA, PA.—Schuylkill Highlands Ry. Co.; to build from Conshohocken to West Conshohocken; $100,000, with $30,000 paid in; Pres., Frederick Phillips.

ALLENTOWN, PA.—Lehigh Valley Traction Co.; $75,000, with $30,000 paid in; Pres., Albert L. Johnson.

WEST CHESTER, PA.—The West Chester & Downington Electric Ry. Co. has elected its officers: Pres., Thomas Pennypacker, of Marshallton; Secretary, Joseph H. Baldwin, of West Chester. Work will be started as soon as the weather permits.

ATLANTA, GA.—The Lithia Spring Ry. Co. proposes to build a road to the Chattahoochee River. B. F. Curtis, Thomas Camp and Harry Camp are interested.

CHICAGO, ILL.—The Ogden Street Ry. Co. has been organized to build an extension of the Cicero & Proviso Street Ry.

ELEVATED RAILWAYS.

PHILADELPHIA, PA.—The Northeastern Elevated Ry. Co. has received permission from the highway supervisors to commence work on its foundations.

CLEVELAND, O.—An elevated railway from the public square to Euclid Height and Gordon Park, is projected by New York capitalists. O. D. Miller, of Brooklyn, O., is interested.

CHICAGO, ILL.—The Metropolitan West Side Elevated Ry. Co. has let a contract for the ironwork for its road to the Carnegie & Phipps Iron Co., of Pittsburg, Pa., at about $3,000,000. Right of way is being secured, and the work is to be completed by August, 1894.—The Chicago & South Side Elevated Ry. Co. has voted an issue of 5% bonds for $5,000,000 to complete the 63d St. extension to Jackson Park, to build extensions to Englewood and the stock yards, and to build the down town loop.

HORSE AND MOTOR RAILWAYS.

WHITE PLAINS, N. Y.—White Plains Ry. Co.; $35,000; line to be 2 miles long; H. Walter Webb, Edgar Van Etten and Chauncey M. Depew.

HARRISBURG, PA.—Lancaster & Downington Street Ry. Co.; $1,000,000, with $100,000 paid in; Pres., H. B. Piper, Tyrone, Pa.

PHILADELPHIA, PA.—Powelton Ave. & 34th St. Ry. Co.; $20,000, with $6,000 paid in; C. J. Young and H. E. Aldrich, Philadelphia, and J. S. Freeman, Wayne, Pa.

EAST MONONGAHELA, PA.—Monongahela City Street

Ry. Co.; line to be 2½ miles long; $15,000, with $3,000 paid in; H. Higinbottom and Daniel A. Cameron, Pittsburg.

WATER-WORKS.

RAYMOND, N. H.—Feb. 28 the people will vote on building works. O. T. Brown, W. J. Dudley and others have been investigating the matter.

ENOSBURG FALLS, VT.—It is reported that water for the new works will be pumped directly to the mains from the Mississippi River, which flows through the village.

BOSTON, MASS.—Bids are wanted until March 6 for 70,000 lbs. iron and service box castings; 8,000 lbs. composition No. 1, 25,000 lbs. No. 2 and 6,000 No. 3. Specifications may be obtained at the office of the superintendent of the Eastern division of the Boston Water-works, 710 Albany St. Robt. Grant, Chn. W. Bd.

WALPOLE, MASS.—Works are talked of.

PROVIDENCE, R. I.—The common council has passed a resolution directing the commissioner of public works "to contract for a suitable system of mechanical gravity filters, capable of filtering 15,000,000 gallons per day, at a cost not to exceed $100,000, provided this system of filtration is recommended by the superintendent of health, the commissioner of public works and the city engineer." The sum of $30,000 is also appropriated by the same resolution for buildings to shelter the filters and $50,000 for pneumatic lifts with a daily capacity of 15,000,000 gallons.

DARIEN, CONN.—A water company may be organized, provided the legislature creates a fire district.

CLINTON, CONN.—Works are projected.

EAST HARTFORD, CONN.—The East Hartford Water Co. has petitioned the legislature for an amendment to its charter permitting it to increase its capital stock to the amount not to exceed $200,000, and also for permission to operate in South Glastonbury and Wethersfield.

GUILFORD, CONN.—The West Haven Water Co. has been surveying preparatory to laying pipes, in case of a charter being granted them by the legislature.

RIDGEFIELD, CONN.—The Ridgefield Water Supply Co. may take their supply from Round Lake and a pumping plant may be necessary. A supply from a deep well has been suggested.

Middle.

FAIRPORT, N. Y.—The citizens have informally voted in favor of establishing municipal works.

HEWLETTS, N. Y.—It is reported that a stock company is being formed to supply Hewletts, Valley Stream, Pearsalls and East Rockaway; pump house and wells to be located at Hewletts.

FALCONER, N. Y.—The Falconer Water Supply Co. is reported as just incorporated; $50,000; A. N. Broadhead, Jamestown; James Hughes, Falconer, and others.

KEENE VALLEY, N. Y.—A gravity supply has been proposed.

MARLBOROUGH, N. Y.—A company is being formed to build the proposed works. It is said that the supply will be from Patchin's Pond.

NEW HARTFORD, N. Y.—A small appropriation for surveys for works has been made.

JERSEY CITY, N. J.—The street and water board rescinded its resolution calling for bids on Feb. 27 for a new supply.

ALTOONA, PA.—It is reported that the contract price for the new reservoir, noted last week, is $166,191.

COATESVILLE, PA.—A special election will be held March 31 to vote on issuing $30,000 of bonds for improvements.

ERIE, PA.—The people have voted against extending the intake for a purer supply from the lake.

HOLLIDAYSBURG, PA.—The people have voted in favor of building new works. The borough built the present plant in 1867. Burgess, John W. Brackner.

NEW WILMINGTON, PA.—A contract for a reservoir has been awarded by the New Wilmington Water supply Co. to McMillen & Moorehead, and for a distribution system to Chandley Bros. Both contractors are of New Castle and $15,000 covers the work.

SABBATH REST, PA.—John Dean, R. W. Christy, Clara Bell and others propose to incorporate the Bell Water Co. to supply Sabbath Rest, Antis township, and that part of Logan township adjoining Altoona on the northeast.

SANDY LAKE, PA.—It is reported that Austin Potter will build a reservoir, lay mains and supply water from springs on his farm.

VOLANT, PA.—It is reported that citizens of the north part of the town will organize a company and build works.

WHITEHALL, PA.—It is reported that A. C. Leisenring, W. W. Watson and others, all of Mauch Chunk, will on March 6 apply for incorporation as the Whitehall Water Co. The move is stated to be in the interest of the Whitehall Land Improvement Co.

North Central.

CLEVELAND, O.—The present intake tunnel will probably be extended 2 or 2½ miles. The purchase of timber for the working shaft is now under construction.

LINWOOD, O.—Plans for water and electric lighting plants will be made by Engr. Geo. Hornung, Cincinnati.

EDINBURG, IND.—Consult. Engr. J. J. Hainsworth, Franklin, informs us that the contract for works has been awarded to Stevens & Bedward, Logansport, for $16,500.

CENTRALIA, ILL.—A new charter has been favorably voted upon which will allow the town to raise money for the new works.

FAIRBURY, ILL.—Bids will be received until March 15 for constructing a distributing system including 20,130 ft. of cast iron pipe, specials, 45 double hydrants and 24 gate valves and boxes. S. M. Barnes, President Board of Trustees; Z. T. Hanna, Clk.

LA SALLE, ILL.—The council has voted to extend the works; estimated cost, $37,570, $8,000 of which is for artesian wells. A new boiler and mains are proposed, as stated last week.

MT. CARMEL, ILL.—The contract for the new works has been awarded to W. S. Reed & Co., The Rookery, Chicago. There will be seven miles of mains and 70 hydrants.

KAUKAUNA, WIS.—Bids will be received until March 15 for a franchise for works as follows: Artesian wells, 100,000-gallon pump, reservoir, two boilers, two 1,500,000-gallon duplex pumps, brick pumping station, 20 × 100-ft. stand-pipe, 8.75 miles 12 to 6-in. cast iron pipe, 85 double hydrants and 36 gates. Proposals must be based on lowest rates for hydrant rental and water for domestic purposes. The city reserves the right to buy the works at any time after five years from the granting of the franchise. C. H. Homer, Cy. Clk.; L. Lindauer, mayor. We understand that Engr. W. F. Goodhue, Milwaukee, prepared the proposed franchise, instead of applying for one as stated last week.

STURGEON BAY, WIS.—Works are proposed.

WAUPACA, WIS.—Private works are proposed.

Northwestern.

ACKLEY, IA.—The "Phonograph" advocates the building of works.

WINONA, MINN.—Cy. Engr. F. H. Pickles informs us that about three miles of 6 to 30-in. pipe will be laid, contracts for which have not yet been awarded.

WILBER, NEB.—Works are proposed.

Southern.

WINSTON, N. C.—It is reported that a contract for works has been awarded by the city to Guild & White, Chattanooga, for $57,700. Steps toward the purchase of the private works are being taken.

GREENEVILLE, TENN.—Humphrey Reaves can give information regarding proposed works.

CLEVELAND, O.—The council has instructed Dir. of Pub. Wks. Herrick to prepare an estimate of the cost of extending the intake tunnel 13,200 ft., with a diameter of 8¾ ft.

HARTWELL, O.—It is reported that the town council has contracted to supply water to Wyoming from its new works for 5 cts. per 1,000 gallons; also that the Hartwell council has accepted plans for works made by H. C. Innes, and will probably advertise at once for pipe and pipelaying.

ASHLAND, WIS.—The council has ordered the company to extend its intake far enough into Lake Superior to secure pure water, which is said to be six miles.

MUKWONAGO, WIS.—Wm. Rust talks of piping a spring three miles to the village and putting in distributing mains.

WINSIDE, NEB.—Works are projected.

Southwestern.

JOPLIN, MO.—The Joplin Water-Works Co. has been incorporated, evidently as a reorganization of the Joplin Water Co. A capital stock of $250,000 and a bonded debt of $200,000 are proposed. Thos. Connor, Pres.; C. W. Glover, Secy.

St. LOUIS, MO.—Bids for building the low service boiler house and smokestack, at the Chain of Rocks, are wanted until March 14. E. S. Foster, Secy. Bd. Pub. Impvts.

ARANSAS PASS, TEX.—A contract for works has been let.

CALDWELL, TEX.—The 50,000-tank connected with the new works burst Feb. 13, the reported cause being the failure of the hoops.

CAMERON, TEX.—Construction of works will soon be started.

EL PASO, TEX.—The fire and water committee has been authorized to supply an engineer to make plans for works.

LOTT, TEX.—A dam across Long Branch to secure water power for works is proposed.

CHANDLER, OKLA.—Works are projected.

Pacific.

LEBANON, ORE.—Dubruille & Rawlins have made a proposition to put in works.

MODESTO, CAL.—The contract for the new city works has been awarded to W. T. Garratt & Co., San Francisco, for $51,200.

NEEDLES, CAL.—It is reported that stock has been taken for a water company.

Canada.

LUNENBURG, N. S.—Works are projected.

ARTESIAN WELLS.

LA SALLE, ILL.—It is reported that about $8,000 will be expended for wells.

ABERDEEN, S. DAK.—The council has let a contract for a well to Swan & Co., at $3.75 per ft.

IRRIGATION.

LA VETA, CAL.—The contract for building the Middle Creek and La Veta sections of the canal and reservoir has been awarded to G. W. Harrison, Littleton. J. W. Montgomery is superintendent of the company.

PASCO, WASH.—N. G. Blalock and F. W. Conn, Walla Walla, and Wm. I. Marriner, Blalock, have filed a claim for 2,000 cu. ft. of water per sec. from Big or Colville Lake, near Sprague. A dam and ditch are proposed.

HOLLYWOOD, CAL.—The Providence Land & Water Co. has had surveys made by Sanders & Coleman for an iron pipe line and laterals to furnish water to land here and at Edgemont and Monte Vista.

TULARE, CAL.—It is reported that H. P. Hagan and E. Barrill, of Traver, have taken a contract to construct a 50-mile ditch, beginning at Tule River, near Portersville in the Tulare irrigation district; price, $50,000.

GUAYMAS, MEX.—Col. E. S. Nettleton, Denver, Colo., has been appointed Chief Engineer and J. A. Johnston, of Cheyenne, Wyo., Superintendent of the Sonora & Sinaloa Irrigation Co., and have started for this place to take charge of the construction of the Yaqui Canal, projected to cover 400,000 acres of land. It is stated that W. S. Logan, New York city, is president of the company, and that it has offices at 41 Jacobson Building, Colo., and 58 William St., New York.

NEW COMPANIES.—Logan Irrigation Canal Co., Camp Clarke, Neb.; $6,000; C. E. Logan, H. S. Hunt, D. W. White. Etiwanda Water Co., Etiwanda, Cal.; $500,000; J. C. Dunlap, San Bernardino, C. N. Ross, Etiwanda; Thos. Hendry, Riverside.

HIGHWAYS.

TEXAS.—The contract for a public road from Beaumont to the Liberty county line, will be re-awarded. Bids are asked until March 7 for ten miles of road in Jefferson county. Ed P. Gray, Co. Judge.

IDAHO.—The bill referred to last week has been signed by the governor, Commissioners from each of the eight counties interested will appoint in April a special state wagon road commission, which will hold its first meeting in Boise City, June 1. Engineers will then be appointed to survey and locate the routes of the several roads of the proposed system, and as soon as possible the contracts will be awarded for the construction. The first work will be done in Boise county and the last in Kootenai.

CALIFORNIA.—The clerk of Sonoma county, at Santa Rosa, has been instructed to advertise for bids for maintaining and keeping in repair the roads, bridges and culverts in 20 road districts, for one year.

SEWERS.

DEXTER, ME.—Plans for a complete sewerage system have been prepared by P. H. Coombs, Cy. Engr., Bangor. The question of construction is to be decided at the next regular town meeting.

DERRY, N. H.—Geo. H. Allen, Manchester, has completed plans for the proposed sewerage system. They provide for 24,827 lin. ft. of Akron pipe sewers, as follows: 15-in., 4,520 ft.; 12-in., 16,145 ft.; 10-in., 4,162 ft.; estimated cost, $55,580. It is hoped to get a small appropriation at the coming town meeting in order to commence the work this year.

BOSTON, MASS.—The metropolitan sewerage commissioners have opened ten bids for section 46 of the main sewer in Winchester, Woburn and Stoneham, the lowest bid being that of Charles Linehan, $13,781. The bids will be published next week.

BROCKTON, MASS.—The sewerage commissioners have completed their report. The intermittent downward filtration method of sewage disposal, upon the Musterfield area, is recommended. A part of this land is in the towns of Easton and West Bridgewater; only about 30 acres suitable for filtration being within the limits of Brockton. The commissioners have prepared plans for 92.5 miles of sewers, estimated to cost over $1,000,000, but it is thought that the expenditure for ten years will be about $700,000. The cost of disposal works is estimated at about $200,000. Authority has already been granted for a loan of $300,000, and the commissioners advise that an additional $100,000 be appropriated at once.

PLAINVILLE, CONN.—Plans for a system of sewers have been prepared by W. H. Cadwell, New Britain.

WATERBURY, CONN.—The city council has voted to petition the legislature for authority to condemn land for sewage disposal purposes, etc., in any town between the city and Long Island Sound, and to issue bonds for $300,000 for the construction of sewage disposal works; also, that the legislature provide for the appointment of the Naugatuck Valley sewerage commission to make surveys, plans and estimates for a trunk sewer throughout the Naugatuck Valley, extending, if necessary, to Long Island Sound, the expenses of said commission to be apportioned among the cities and towns to be benefited.

BUFFALO, N. Y.—The department of public works will receive bids until March 8 for four 12 to 30-in. tile sewers, and one 2.5 to 5.5-ft. brick sewer.

FORT PLAIN, N. Y.—The plans for a sewerage system have been approved by the state board of health. It is expected that a vote on the question of construction will soon be taken.

NEW YORK, N. Y.—The commissioner of street improvements in wards 23 and 24 will receive bids until March 16 for two sewers.

ROCHESTER, N. Y.—The East Side trunk sewer commission will receive bids until March 6 for section 9 of the main sewer; 4,011 lin. ft. The following bids were received for section 8: Wm. Fuller, $93,533; H. M. Cowles, $96,223; Brayer & Albaugh, $129,416; Chambers & Casey, $104,154; Bruff, Horn & Co., $101,360; Robinson & Pond, $106,200; Whitmore, Rauber & Vicinus, $110,224.

PHILADELPHIA, PA.—The city council has voted to construct sewers in 32 streets.

TYRONE, PA.—The proposed loan of $20,000 for a main sewer was defeated at the special meeting Feb. 21.

WASHINGTON, D. C.—Rudolph Hering, New York, was in the city last week as consulting engineer to examine the plans of proposed sewers.

ALBANY, GA.—The city council has voted to complete the construction of the sewerage system; estimated cost, $34,000.

MEMPHIS, TENN.—Col. Geo. E. Waring, Jr., has been engaged by the city council as consulting engineer of a proposed system of sewers in South Memphis. No plans have yet been prepared.

BUCYRUS, O.—The city engineer will receive bids until March 7 for several sewers.

TOLEDO, O.—The city clerk will receive bids until March 13 for eight 20 to 24-in. brick sewers and one 15-in. pipe sewer.

DETROIT, MICH.—We are informed by S. A. Ferguson, Asst. Cy. Engr., that about 25¼ miles of lateral, and 8 miles of main sewers were built in 1892. About the same amount of sewer building is anticipated in 1893. The city has 365 miles of main and lateral sewers.

INDIANAPOLIS, IND.—The city engineer has specifications nearly completed for six additional sewers, including the state ditch sewer, which will be 11,155 ft. in length, and range in size from 5½ ft. to 8 × 12½ ft. The plans of Rudolph Hering call for an expenditure of $6,000,000, and the work is being advertised as fast as specifications can be prepared.

ST. LOUIS, MO.—The board of public improvements will receive bids until March 14 for sewers in four districts.

SALT LAKE CITY, UTAH.—The city council has appropriated $300,000 for the proposed gravity sewer system. This sewer will be 5 ft. in diameter, 6 miles long, and be built of brick and concrete. The work will be commenced as soon as possible, and it is expected to be completed this year. It will be under the direction of the city engineer.

REDWOOD CITY, CAL.—The contract for a sewer system has been awarded to A. E. Buckman, San Francisco, at $22,718. There were 27 bids, the next to lowest being $22,731.

STREETS.

HOLYOKE, MASS.—The committee on sidewalks has been authorized to advertise for bids for 10,000 ft. of granite curbing.

LOWELL, MASS.—The board of aldermen has authorized a loan of $30,000 for paving.

ALBANY, N. Y.—The city engineer is preparing estimates for paving in nine streets with granite blocks, and in one with asphalt.

BROOKLYN, N. Y.—The commissioner of city works will receive bids until March 8 for grading and paving with cobble stones in four streets. John Curran was the lowest bidder for grading in six streets, at about $36,000, and J. F. Gillen in one, at about $20,000.

NEW YORK, N. Y.—Bids are asked until March 7 for paving with granite blocks and asphalt, four contracts; and until March 9 and 16 for grading, flagging and paving with trap blocks, eight contracts, in wards 23 and 24.

BALTIMORE, MD.—The city council has appropriated $1,184,000 for paving with Belgian blocks. The amount set apart for paving in the $6,000,000 loan is $1,600,000. The blocks used are 8 to 12 ins. long, 4 to 4.5 ins. wide and 6 ins. deep, and cost the city from $67.50 to $70 per M.

BEREA, O.—The village clerk will receive bids until March 6 for grading, curbing with sandstone, and paving with brick in Front St.

DAYTON, O.—The board of city affairs has ordered a large number of sidewalk improvements. Bids are asked until March 27 for about 50,000 sq. yds. of paving with Medina block, Hayden block, Hallwood block, asphalt or brick.

TOLEDO, O.—The city clerk will receive bids until March 20 for seven contracts for paving with cedar blocks, Medina stone, vitrified brick, asphalt blocks, or Trinidad asphalt.

DETROIT, MICH.—We are informed by S. A. Ferguson, Asst. Cy. Engr., that about 25.5 miles of pavement were laid last year, and that about the same amount will be put down in 1893. The city has 500 miles of streets, of which 192 miles are now paved.

SOUTH BEND, IND.—Bids will be received until March 13 for 42,000 sq. yds. of brick paving, 12,000 lin. ft. of cement curbing, and 14,000 cu. yds. of grading. W. M. Whitten, Cy. Engr.

MILWAUKEE, WIS.—Cy. Engr. Benzenberg recommends that the city pave several important streets with asphalt.

ST. LOUIS, MO.—The board of public improvements will receive bids until March 7 for five contracts, including two for paving with granite blocks; and until March 14 for paving two streets with Trinidad Lake asphalt, with a guarantee for ten years.

ELECTRICAL.

ADDISON, N. Y.—The contract for electric street lighting has been awarded to F. H. Wheaton. It calls for 25 arc lights of 2,000 c. p., and the plant is to be completed before Aug. 1, 1893.

JAMESTOWN, N. Y.—The board of public works has recommended that $30,000 be expended in increasing and enlarging the electric light plant.

MIDDLETOWN, DEL.—We are informed by John W. Jolls, Secy. Light and Water Com., that bids will soon be asked for a municipal electric light plant. The system has not been decided upon.

RADFORD, VA.—The Radford Electric Light & Power Co. has been incorporated; capital stock, $35,000.

NASHVILLE, TENN.—The City Electric Light & Power Co. has been incorporated by M. A. Spurr, J. N. Brooks, and others, and has applied for a franchise. The ordinance that is being considered proposes that the city contract with this company for 350 lights for five years at $85.775 per light per year. Offers for public lighting have also been submitted by other companies.

DETROIT, MICH.—Bids were opened Feb. 20 for furnishing the city with electric lights for 1, 2, 3, 5, 7, or 10 years. The only bid received for street lighting was that of the Detroit Electric Light & Power Co., which offered a contract for 1 year at 45 cts. per night for each tower lamp, 42 cts. for arms, and 41 cts. for pole lamps; for 2 yrs., 43 .40 and 39 cts.; 3 yrs., 37, 33 and 32 cts.; 5 yrs., 36, 32 and 31 cts.; 7 yrs., 33, 29 and 28 cts.; 10 yrs., 31, 27 and 26 cts.; for lighting the city hall and court building with incandescent lights, 70 cts. per 100 16-c. p. lamp hours. The Edison Illuminating Co. offered to light these buildings at $1 per 100, 16-c. p. lamp hours. The present contract of the Detroit Electric Light & Power Co. is for 827 lamps, at $115.825 per year, and for each additional lamp 35 cts. per night. The city is now paying for 1,279 lamps.

WYANDOTTE, MICH.—It is reported that bids will soon be asked for a municipal electric light plant.

JEFFERSON, WIS.—An electric light franchise has been granted to Geo. Grimm. About 67 incandescent lights of 32 c. p. will be used for street lighting, and light will be furnished for places of business and about 40 residences.

CENTRALIA, ILL.—The company referred to last week has been organized as the Marion County Rapid Transit Co.; capital stock, $75,000. It is proposed to build and operate electric railways, and furnish electric light, heat and power in this place, Central City, Sandoval, Odin and Salem, towns having a population of about 10,000, within a distance of 15 miles.

CHICAGO, ILL.—The question of municipal lighting is being discussed. The city controller reports that the city is paying at the rate of $175 per lamp per year for lights in South Chicago, and in the town of Lake.

MOUNT OLIVE, ILL.—The village clerk will receive bids until March 13 for an electric light plant, and for furnishing lights for public and private use; franchise to be for five or ten years.

NEW COMPANIES.—Panther Valley Electric Light, Heat & Power Co., Lansford, Pa.; $10,000; W. W. Thomas, G. W. Davis, W. Drumheller. Altoona Electrical Engineering & Supply Co., Camden, N. J.; 15,000; W. F. Taylor, A. B. Norton, W. H. Markland, Altoona. Adonis Electric Mfg. Co., Chicago, Ill.; $500,000; Wm. B. Mather, Wm. L. Sutherland; J. S. Wheeler, Jr.

CONTRACT PRICES.

Ironton, O.—The following total bids were received Feb. 18 for 8,300 lin. ft. of main sewers: C. L. Crowley, Cincinnati, $35,807; Berry & Davis, Bellaire, 39,256; P. H. Kelly, Portsmouth, $33,166; Chas. R. Diemar, Ironton, $19,895; O. R. Heins, Scio, $41,124; John J. Shipman, Washington, D. C., $32,328; Fred. Klienman, Findlay, $28,802; B. D. Bartow, Port Huron, Mich., $35,584; Wilson & Strack, Cincinnati, $24,626; H. C. Babbitt, Columbus, $30,887; H. L. Wright, Huntington, W. Va., $50,926; Frank Gebert, Fostoria, $30,366; Day & Dougherty, Bellaire, $43,492; Schreiber & Dillon, Ironton, $21,975; T. J. Mulligan, Ironton, $30,599.

SEWERS.—Pawtucket, R. I.—We are informed by A. R. Sweet, Engr. in charge, that the contract for a sewer in Central Ave. has been awarded to the National Construction Co. The work includes; A, 460 lin. ft. of 4 ft. 6-in. sewer; B, 2,350 lin. ft. of 7 ft. 3-in. sewer in tunnel; C, 150 lin. ft. of same, open cut; D, 1,640 lin. ft. of 5-ft. sewer, open cut; E, 398 lin. ft., height of manholes; F, rock excavation, per cu. yd. The prices given below are per lin. ft. for sewer complete, the bidders being as follows: 1, National Construction Co., Boston, Mass.; 2, Thomas Craig, Trenton, N. J.; 3 Everson & Liddle, Providence; 4, F. E. Shaw, Providence; 5, F. A. Snow, Providence; 6, J. J. Newman, Providence; 7, Moulton & O'Mahoney, Boston, Mass.; 8, J. D. Brown, Central Falls; 9, H. P. Nawn, Boston, Mass.

	A.	B.	C.	D.	E.	F.
1	$7.60	$26.80	$19.08	$13.97	$3.00	$3.85
2	8.48	31.21	19.69	16.34	3.50	3.50
3	13.75	33.00	27.00	20.00	8.00	4.00
4	10.00	35.00	30.00	20.00	4.00	4.00
5	11.50	55.50	30.00	30.00	4.00	7.00
6	13.50	63.00	37.00	28.50	14.00	5.00
7	16.50	48.85	30.00	23.50	25.00	15.00
8	7.00	28.00	....	....	8.00	5.00
9	11.50	36.18	....	....	59.00	4.00

The bids ranged as follows: Excavation, 19,000 cu. yds., 40 to 80 cts. per cu. yd.; 24-in. cast iron pipe, 210 ft., $3.48 to $7.42 per lin. ft.; 42-in. double ring brick sewer, 850 ft., $1.88 to $6.55; 36-in., 3,000 ft., $1.66 to $4; 34-in., 200 ft., $1.58 to $3.95; 32-in., $1.52 to $3.75; 30-in., $1.45 to $3.75; 36-in. single ring, $1.02 to $3.55; 34-in., 900 ft., 75 cts. to $3.25; 32-in., 1,100 ft., 73 cts. to $2.95; 30-in., 2,400 ft., 70 cts. to $2.65; 34 manholes, 8 ft. deep or less, $14.40 to $35 each—each additional foot, 100 ft., $1.25 to $4; concrete, 200 cu. yds., $1.25 to $7 per cu. yd.; 18-in. ring branches, $1.37 to $7 each; 15-in., 10, $1.05 to $5.55; 12-in., 6, 82 cts. to $4; 18-in. straight pipe, 65 cts to $1.75 for each piece 2 ft. long; 15-in., 50 pieces, 50 cts. to $1.65 each; 12-in., 60, 42 cts. to $1.30; 10-in., 100, 33 cts. to $1; 8-in., 100, 20 to 77 cts.; 6-in., 220, 14 to 60 cts.; 12 or 15-in. stoppers, in place, 35, 3 cts. to $1 each; 8 or 10-in., 150, 3 to 50 cts.; 6-in., 300, 3 to 40 cts.; 10-in., curves, 45 cts. to $2.60 for each piece 2 ft. long; 8-in., 40 cts. to $1.60; 6-in., 28 cts. to $1.30; castings, at outlet, ring and cover, complete, 3,000 lbs., 2.5 to 6 cts. per lb.; coping stone, 10 ft., 50 cts. to $1.50 per lin. ft.; brickwork, 3,000 ft., $10 to $22 per M. J. R. C. Brown, Cy. Engr.

Hoosick Falls, N. Y.—The contract for a sewer system has been awarded to Sears & Emonson, Kingston, at $32,628, as stated in our issue of Feb. 16. The more important prices were as follows: 20-in. sewer pipe, 70 cts. per lin. ft.; 18-in., 700 ft., 48 cts.; 15-in., 4,800 ft., 37 cts.; 12-in., 3,000 ft., 27 cts.; 10-in., 4,600 ft., 21 cts.; 8-in., 50,000, 15 cts.; 4-in. drain tile, 1,000 ft. 4 cts.; cast iron pipe, 10 tons, $33 per ton; 100 manholes, $31 each; 20 flush tanks, without fittings, $56 each; 40 flush tanks, complete, $66; 30 lampholes, $6.50; rubble masonry, 30 cu. yds., $3 per cu. yd.; earth refilling, 1,000 cu. yds. 20 cts.; excavation, 14 cts. to $1.25 per lin. ft., according to depth, from 5 to 22 ft.

MISCELLANEOUS.

GARBAGE DISPOSAL.—Buffalo, N. Y.—We are informed by Edwin F. Bishop, Secy. Dept. Pub. Wks., that all bids received for garbage disposal have been rejected, and that new bids will probably be advertised for, but owing to the division of opinion among members of the council it is impossible now to state the kind of contracts that will be awarded.

DREDGING.—Philadelphia, Pa.—The board of wardens for the port of Philadelphia will receive bids until March 6 for dredging.

New York, N. Y.—The department of docks will receive bids until March 9 for 147,000 cu. yds. of dredging in the North River.

CEMENT.—Portland, Me.—Bids will be received at the U. S. Engineer Office until March 15 for 15,000 bbls. of hydraulic cement. Lieut.-Col. Peter C. Hains, U. S. Engr.

NATURAL GAS.—Parsons, Kan.—Parsons Mining & Gas Co.; $50,000; A. P. McBride and Wm. Bloom, Paola; L. J. Beagle and others; to bore for natural gas for lighting and heating purposes.

GAS LIGHTING.—Newark, N. J.—The following bids have been received for gas lighting: Citizens' Gas Light Co. contract for one year, street lamps, 3,300 hours, $20 each; municipal buildings, $1.40 net per 1,000 ft.; private consumers, $1.60 and 10% off if promptly paid; for ten years, street lamps 3,300 hours, $16; 4,000 hours, $19 each; municipal buildings, to $1.25 per 1,000 ft.; private consumers, the first five years, $1.55 and 10% off; second five years, $1.50 and 10% off. Newark Gas Light Co., for ten years, same as preceding except that for private consumers the price was $1.45 and $1.40.

Boston, Mass.—Bids were opened Feb. 24 for gas lighting. Eight companies submitted bids, the prices being in most cases from 10 to 20 cts. per 1,000 cu. ft. lower than the present contract price. They ranged from 70 cts. to $1.75 per 1,000 cu. ft. for public lighting, and from $1 to $2 for consumers, according to company and location of light.

LOCK AND DAM.—Charleston-Kanawha, W. Va.—The following bids were opened Feb. 16 by Col. Wm. P. Craighill, U. S. Engineer Office, for building lock No. 9, of the Great Kanawha River improvement, and the movable dam connected therewith: Humphrey Devereux, Shawneetown, Ill., $287,712; Zimmerman, Truax & Sheridan, Duluth, Minn., $283,344; Carkin, Stickney & Cran, East Saginaw, Mich., $322,385; Harold & McDonald, Pittsburg, Pa., $322,560; Thos. Munford, Lock Seven, W. Va., $293,950; Joseph Gianini, Allegheny City, Pa., $329,272.

GAS COMPANY.—Steelton, Pa.—People's Gas Co.; $20,000; Treas., Chas. B. McConkey, Harrisburg.

MANUFACTURING AND TECHNICAL.

LOCOMOTIVES.—The Rogers Locomotive & Machine Works, Paterson, N. J., are building 8 suburban tank engines for the Illinois Central; they have four driving wheels, a two-wheel leading truck, and a six-wheel trailing truck under the tank. The Cooke Locomotive & Machine Works, Paterson, N. J., are building a ten-wheel compound engine, 3 eight-wheel engines and 2 six-wheel switching engines for the Delaware, Lackawanna & Western. The Pittsburg Locomotive Works, Pittsburg, Pa., have an order for 3 passenger and 3 freight engines for the Pittsburg & Lake Erie. The Brooks Locomotive Works, Dunkirk, N. Y., are building 10 consolidation freight engines for the Buffalo, Rochester & Pittsburg. The Grant Locomotive Works, Chicago, Ill., have delivered 4 four-wheel switching engines to the Chicago, Milwaukee & St. Paul.

CARS.—The Ohio Falls Car Co., Jeffersonville, Ind., is building 5 mail cars for the Chicago & Eastern Illinois and the Evansville & Terre Haute. The Pullman Palace Car Co., Chicago, Ill., has an order for 25 passenger cars for the Central of New Jersey. The Union Car Co., of Lancaster, N. Y., has been organized with $400,000 capital stock. The Northern Car Co., of Minneapolis, Minn., is to be reorganized, according to report. The J. W. Brill Co., Philadelphia, Pa., is building 10 street cars for the Brooklyn & Newtown. The Pullman Palace Car Co., Chicago, Ill., and the Ohio Falls Car Co., Jeffersonville, Ind., are building 1,000 and 500 cars, respectively, for the Pittsburg, Shenango & Lake Erie.

CAR WORKS.—The contract for the erection of the buildings for the Union Car Co., at Depew, N. Y., has been awarded to Voorhees & Whitman. The Michigan-Peninsular Car Co., of Detroit, Mich., will probably move to Chicago, and establish extensive works near that city.

BRIDGES.—The Louisville, New Albany & Chicago R. R. has engaged Lee L. Dagron, Rookery Building, Chicago, to inspect some new bridges to be built at the shops of the American Bridge & Iron Co., Chicago; Pres., Paul Richter. They are to be erected by F. J. McCain & Co., Chicago.

RUST PREVENTIVE.—A new rust preventive, which has been recently introduced in Germany, and is said to be very popular there, is being put on the American market by Vilmar & Goetze, of 81 New St., New York. The compound consists of grease held in solution in volatile oils, and is about the consistency of vaseline. It is applied in a thin coating with a brush, and can be easily removed by rubbing with cotton waste wet with turpentine. Great durability is claimed for the coating, and as it is colorless, it is well suited for protecting polished brass or steel goods, especially those intended for a tropical market, or which have to stand sea transportation. It is being used in Germany by builders of machine tools, firearms, railway machinery, cutlery, pipe, builders' hardware, etc.

AERATED FUEL CO.—This company's patents on its system of burning crude petroleum by the use of compressed air have been sustained in its suit against Cox & Sons' Co., and two firms of glass manufacturers who infringed the patents. A copy of the decision may be obtained from the company, at Springfield, Mass. The system was illustrated and described in our issue of Nov. 30, 1889.

RUFFNER & SON, Philadelphia, Pa., is the new name of the firm of Ruffner & Dunn, makers of the Excelsior nut locks.

COFRODE & SAYLOR, structural iron and bridge works, Pottstown, Pa., are reported to have been put into the hands of receivers. It is expected that the works will continue in operation, as there are heavy contracts on hand for elevated railway material and for buildings at the World's Columbian Exposition.

R. J. & A. B. CRAM, of Detroit, Mich., have received an order from the Missouri River Commission, of St. Louis, Mo., for a steam pile hammer, with 5,500-lb. ram. They have recently shipped one to Omaha, Neb., and two to Gasconade, Mo.; and the Cram steam pile hammer is now in use in several states and in Canada.

NEW COMPANIES.—Canon Brick & Tile Co., Canon City, Colo.; Pres., C. W. Burrage; Gen. Man., W. H. Trout. McKenney Derrick Co., Lincoln Center, Me.; $10,000; Pres., S. H. Clay; Secy., Harry Butterfield. Chicago Street Improvement Co., Chicago, Ill.; $25,000; John Bonner, L. J. Nelson and James Hollaran. Superior Dredging Co., Superior, Wis.; $200,000; T. M. Todd, of Milwaukee, Wis.; Harrett Record, of Minneapolis, Minn., and B. B. Inman, of Duluth, Minn. Milwaukee Asphalt Paving Co., Milwaukee, Wis.; $80,000; Henry Weber, F. Kraus and N. Ryan. Althouse Automatic Car Coupling Co., Chicago, Ill.; $3,000,000; Harry Vincent, Wm. Banneman and J. C. Amend. National Pneumatic Water Elevator Co., Milwaukee, Wis.; $500,000; C. M. Kendall, L. E. Pond and C. H. Keeney. New Jersey Construction Co., Newark, N. J.; $100,000, with $1,000 paid in; R. B. Smith and S. M. Levin, of New York, N. Y., and F. J. H. Atwood, and F. S. Hamel, of Brooklyn, N. Y.

CURRENT PRICE LIST.

RAILS.—New York: $29 at eastern mills and at tidewater; girder rails, $35 to $36; old rails, $16.50 for iron, and $13 for steel. Pittsburg: $29; old rails, $20 for iron and $15 to $15.50 for steel. Chicago: to $32 for standard sections; old rails, $18.50 for iron and $11.50 to $15 for steel.

TRACK MATERIAL.—New York: steel angle bars, 1.55 to 1.6 cts.; spikes, 1.9 to 1.95 cts.; track bolts, 2.4 to 2.45 cts. with square and 2.55 to 2.6 cts. with hexagon nuts. Pittsburg: splice bars, 1.75 to 1.77 cts. for iron and 1.8 cts. for steel; iron and steel spikes, 2.15 cts.; iron track bolts, 2.7 cts. with square and 2.8 cts. with hexagon nuts. Chicago: splice bars, 1.65 to 1.7 cts. for iron and steel; spikes, 2 to 2.05 cts. at mill; track bolts, 2.6 to 2.65 cts. with hexagon nuts.

PIPE.—Cast iron, $20 to $30 per ton. Wrought iron discounts as follows at Pittsburg: 55% and 10%, and 47½% and 10% on black and galvanized butt welded; 65% and 10%, and 55% and 10%, on black and galvanized lap welded. Casing, 57½%.

FOUNDRY PIG IRON.—New York: $13.25 to $15. Pittsburg: $12.75 to $14. Chicago: $12.50 to $13.75.

LEAD.—New York: 3.95 to 4 cts.; Chicago: 3.77 to 3.8 cts.; St. Louis: 3.65 to 3.67 cts.

STRUCTURAL MATERIAL.—New York: beams, 2.05 to 2.4 cts.; channels, 2.1 to 2.2 cts.; angles, 1.85 to 2 cts.; tees, 2.1 to 2.3 cts.; sheared iron plates, 1.85 to 2.1 cts.; steel plates, 1.85 to 2 cts. for tank, 2.1 to 2.25 cts. for shell, 2.4 to 2.5 cts. for flange, 2.6 to 2.8 cts. for firebox. Pittsburg: beams, 1.8 to 1.9 cts.; channels, 1.8 to 1.9 cts.; angles, 1.7 to 1.75 cts.; tees, 2 to 2.1 cts.; Z bars, 1.9 cts.; universal mill plates, 1.7 to 1.75 cts.; sheared steel bridge plates, 2.1 to 2.25 cts.; refined bars, 1.7 cts. for iron and steel; steel plates, 1.7 to 1.75 cts. for tank, 1.95 to 2 cts. for shell, 2.05 to 2.1 cts. for flange, 3.4 to 3.5 cts. for firebox, 1.9 to 2 cts. for bridge. Chicago: beams, 2 to 2.1 cts.; channels, 2.27 to 2.5 cts.; angles, 1.85 to 1.95 cts.; tees, 2.2 to 2.3 cts.; sheared plates, 1.9 to 1.95 cts.; universal plates, 1.85 to 1.95 cts.; steel plates (at mill), 1.9 to 2 cts. for tank, 2.12 to 2.25 cts. for shell, 2.27 to 2.3 cts. for flange, 2.7 to 2.8 cts. for firebox.

INDUSTRIAL SUPPLEMENT TO ENGINEERING NEWS.

NEW YORK, MARCH 2, 1893.

ASPHALT PAVEMENTS: HOW THEY SHOULD BE CLEANED.

All street pavements should be kept as clean as possible. The uneven surface and the joints between the blocks make it difficult to keep stone or wooden block or brick pavements as clean as they should be. Asphalt pavements, on the contrary, having a hard, even, and smooth surface, can, without difficulty, and at a small cost, be kept as clean as the floor of a gentleman's stable or carriage house.

No one who has ever seen a properly cleaned and cared for asphalt pavement can have failed to be impressed with its beauty and the comfort it affords those who use it. Travelers universally notice and praise the admirably kept asphalt pavements of London and Paris, and speak of them as luxuries that we cannot hope to enjoy in America. Nothing could be further from the truth.

Our asphalt pavements in this country are fully equal to the foreign pavements, except in the one essential of cleanliness, and there is no good reason why they should not be equally well cared for in that respect. This is not an idle assertion; it is a fact which experience has proved.

No people are more willing than Americans to incur the expense necessary to secure the best of everything in the way of the comforts and conveniences of living, but it may be justly said that after spending money freely for the first cost of the things we want, we are apt to become negligent and slothful in taking care of them. So with asphalt pavements; everybody admires their beauty and cleanliness when they are first completed and opened for travel, but no provision is made for keeping them in that condition. The dirt is allowed to accumulate upon the surface; in rainy weather this dirt becomes mud, and in dry weather it becomes dust, which is carried by the wind upon the faces and clothes of those using the street, or into the business houses or homes of the residents. To remedy the latter evil, the sprinkling cart—of which it may be said that "it never rains but it pours"—is called in, the street is deluged with water, and what before was dust becomes a mass of reeking slush, which no lady can cross without imminent peril to her shoes and her skirts, and which, under the hot sun gives off a varied assortment of bad smells, and worst of all, forms a fertile hot-bed for the propagation and dissemination of disease-producing germs. When thus covered with slimy mud, an asphalt pavement, which in any other state affords a sure foothold for horses, is more or less slippery. These conditions pertain to pavements of all kinds, but they are less excusable in the case of asphalt pavements, because of the ease and the comparatively small cost of remedying the evil on that kind of pavement. It is the object of this article to point out how asphalt pavements should be cleaned; the implements necessary, and the cost of the work.

There are two general systems of street cleaning which may be designated as "Machine Cleaning" and "Hand Cleaning," or, as the latter is called abroad, the "Orderly System."

MACHINE SWEEPING.

In this method the surface of the street is swept at intervals of one or more days by street sweeping machines drawn by horses. The work is usually done at night, so as to incommode travel as little as possible. The

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machines sweep the dirt from the center each way to the gutter, where it is collected into little piles by the use of hoes and brooms, and is then shoveled into carts or wagons and hauled away. The street should be lightly sprinkled—only enough to lay the dust—just in advance of the sweeping machine.

The objections to this system are:

1st. Even if the pavement is swept every day, the horse droppings and other dirt will, during hot days, become dry and converted into dust by the travel, and will thus render resort to sprinkling necessary.

2d. Unless the surface of the pavement is in just the right condition, the machine brooms do not clean the street satisfactorily.

If the dirt is too dry, the power brooms raise a large volume of dust which floats away into houses or settles back upon the street. If the street is wet and sloppy, the brooms do not properly remove the dirt, but only plaster it upon the surface of the pavement, to be ground to dust during the next day, or to be converted into slush if flooded by the water carts.

3d. The sweepings are often not promptly hauled away, and the travel on the street scatters them about over the pavement again, thus rendering the previous labor useless.

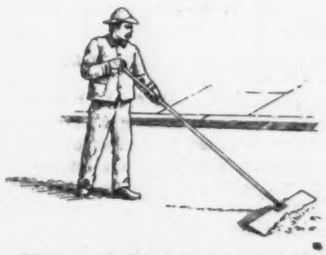
HAND SWEEPING.

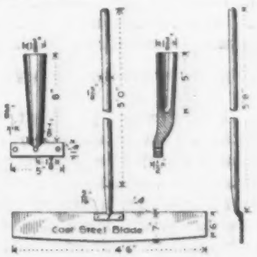
This is the system employed in cleaning the asphalt pavements in foreign cities, and which has rendered these pavements so famous and so admired by travelers.

It consists in dividing the streets into sections, each of which is cleaned by one man or boy, who is responsible for the condition of the pavement under his charge. The implements required by each man, and their cost, are as follows:

One street scraper	$3.00
Two brooms, with handles, each	.75
One scoop shovel	.85
One hand barrow	2.00

The scraper that is found best for the purpose is, we believe, an American tool, its place being taken in foreign cities by the "squeegee," which it is not necessary here to describe. The scraper, as well as the method of using it, is sufficiently described in the illustrations following.





When pushed before the operator, as shown, the thin steel blade accommodates itself to small inequalities in the surface of the pavement and is a most effective tool for removing and collecting mud or damp droppings from the surface of the pavement. It is not, so far as we know, upon the market, but any good blacksmith, with the aid of the drawings here given, can make it.

The brooms most suitable for sweeping asphalt pavements are what are known as "Bass" brooms of the usual form of street brooms. They should be twenty or twenty-two inches long and of the best quality. Those made by J. McArthur & Co., No. 131 Reade street, New York, have been found by experience first-rate, but they can doubtless be secured of equal quality from other manufacturers. If bought in quantities a considerable discount from the price given above could probably be secured. The shovel best suited for the purpose is the ordinary scoop shovel of medium size. Any good wheelbarrow will answer for carrying the sweepings the short distance necessary to some place of temporary deposit until taken up and carted away. There are several styles of handcart made especially for this purpose, but they cost much more than wheelbarrows, which serve the purpose very well.

HOW THE WORK IS DONE.

The men employed spend the whole of the day from 6 A. M. to 6 P. M. (excepting the time required for the midday meal), upon the part of the street assigned to them. When the street is dry, each man should, during the early morning hours, while travel is light, and at other times as opportunity may offer, sweep thoroughly at least a part of his street with the hand brooms, to remove the dust. He should get over the whole of his work in this way every two or three days. During the remainder of the time he passes rapidly over his work, removing with the scraper or brooms, or both, the fresh droppings before they have had time to dry and to become ground into dust. If this part of the work is faithfully done, it will be found that very little dust will accumulate on the pavement unless the street is very heavily traveled. By the skillful use of the scraper, the moist dirt can be rapidly collected and removed by the wheelbarrow or hand cart. In wet weather the dirt will be almost wholly removed by means of the scraper, which is the most effective tool known for use on the smooth asphalt surface. The work is not laborious, but requires active, alert men or boys to do it properly.

The final disposal of the accumulated street sweepings will depend on circumstances. It is usually removed at stated intervals by the carts of the street cleaning department. Where, as can generally be arranged, the carts can make four or more trips over the street each day, the sweepings can be taken up directly from small piles which may be made at points on the street where they will be least disturbed by the travel, as in the gutters, in the entrances to alleys, etc. In European cities the sweepings are put into small iron boxes or bins located at convenient points along the street or upon the edge of the sidewalk, and the bins are emptied every night only. In this country the occupants of property along the streets generally object to these bins, claiming that the effluvium given off from

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the sweepings is objectionable, and that the bins themselves are unsightly and obstruct the street. The amount of sweepings from asphalt streets is not great, averaging on a block of the usual length about one-fourth of a pound per day for each vehicle passing over the street.

AMOUNT OF ASPHALT PAVEMENT ONE MAN CAN CLEAN, AND THE COST OF THE WORK.

The amount of pavement one man can properly care for in this way varies with the amount of travel; on residence streets with light travel, one man can keep from two thousand to three thousand linear feet of street (say 36 feet wide) in a thoroughly satisfactory condition. On downtown business streets, with very heavy travel, one ordinary block, say 400 feet long, is about as much as one man can care for.

The following examples will best illustrate the amount of labor required and its cost: On Collingwood Avenue, Toledo, Ohio, length 3,750 ft., width between curbs, 30 ft., one man is constantly employed and has an assistant about eight days out of each month. Total cost (exclusive of cost of tools and hauling away sweepings), $50.00 per month, or about one and one-third cents per linear foot of street per month.

On Jarvis street, Toronto, (the leading residence street of the city, with a moderately heavy travel), each man took care of about 1,350 lin. ft. of street, 36 ft. wide, and kept the street in very satisfactory condition.

On Race street, Cincinnati, 42 ft. wide, several squares were cleaned and cared for under this system. The work was undertaken and carried on as a practical lesson to the occupants along the street in cleaning an asphalt pavement, and proved highly satisfactory to all. It required one man to each square of about 400 feet in length. The travel over this part of the street averages over five thousand vehicles and nearly seven thousand horses per day.

It will thus be seen that an asphalt paved residence street of moderate travel can be, in this way, cleaned and cared for at about the usual price paid for street sprinkling.

SPRINKLING.

When an asphalt paved street is cleaned in the way described above it will be found that sprinkling is seldom required. There will be times during gusty weather when the small amount of dust that will always remain on any pavement, however well it may be cleaned, will be raised and blown about. On such days very light sprinkling, just enough to keep the dust from flying, would be desirable. This may be best done by providing the men who do the cleaning with a reel of garden hose say one hundred feet long, and making suitable connections with the city water pipes at distances of say two hundred and fifty feet apart, to which the hose may be attached when required. The street can thus be sprinkled lightly as frequently as may be necessary, at little or no expense in addition to the cleaning. Under no circumstances should the pavement be flooded by water carts. There are, it is true, sprinkling wagons fitted so that the amount of water discharged upon the street can be nicely regulated, but even with these the drivers are likely to be careless and to flood the pavement. It will be found better and cheaper to keep the sprinkling wagons off of asphalt pavements altogether.

Another objection to excessive sprinkling is that it greatly reduces the life of pavements of all kinds. Every one who has visited stone working machinery has observed that, where stone is to be sawed into or ground away, a constant stream of water is kept dropping upon the part to be cut; and if one asks why this is done, he will be told that it greatly expedites the work, and that without the water the process of sawing or grinding the stone would be a very slow one. So with pavements, whether of stone or other material, if they are kept constantly flooded with water, their life will be greatly shortened, and for this reason, if for no other, sprinkling should be avoided wherever it is possible to do so.

A few letters from citizens and city officials of cities where the above described method of cleaning has been tried are appended to show what they think of it.

Mayor's Office, William Breedon, Mayor,
Amsterdam, N. Y., November 1, 189[illegible].

Messrs. Warren-Scharf Asphalt Paving Co., New York City, N. Y.:

Gentlemen: In answer to your inquiry as to the comparative condition of the asphalt pavements laid by your company, in this city, prior to and since the abolishing of street sprinkling, will say that while the pavements were sprinkled they were continually in a dirty, slippery, unsafe and unsatisfactory condition.

About two months ago the city passed an ordinance prohibiting the sprinkling of these pavements, since which time they have been cleaned by hand. Two men clean about one-third of a mile of the business portion of the principal street of the city, which is about fifty feet wide.

The street is now in a much more cleanly and healthful condition, and very much more satisfactory to the merchants along the street as well as to all others who travel the pavement. Most respectfully yours,

(Signed) WILLIAM BREEDON, Mayor.

Engineering Department, City of Amsterdam,
F. E. Crane, Engineer.
Amsterdam, N. Y., November 5, 1892.

Mr. George C. Warren, Supt. Warren-Scharf Asphalt Paving Co.:

Dear Sir: This city now has 25,242 square yards of your Trinidad asphalt pavement, covering about 1.08 miles of streets. For one year after its construction no provision was made for cleaning it, and the dust was laid by continual sprinkling. Aside from the protests of those interested in the pavement and an occasional warning from your company, the system of thus allowing the street filth to accumulate and then wetting it down in layers has been condemned by both the citizens and Common Council. It became a nuisance to pedestrians, dangerous to horses from the slippery surface it produced, and a menace to the public health. Since prohibiting the sprinkling of this pavement by an ordinance of September 5, 1892, that portion fronted by the business portion of the city, about 10,400 square yards, together with 2,400 yards of brick pavement, has been cleaned by two men, with hand scrapers and brooms. These men are hired by the

A FINISHED PAVEMENT

occupants of the properties along the streets, and the piles of dirt are removed by the city teams. This means of cleaning the pavement has proved very satisfactory. The appearance of the street is immeasurably improved, the hard, dry surface furnishes abundant foothold for all teaming, while the wind, which before raised clouds of dust as soon as the moisture had evaporated, now causes little or no annoyance.

Thanking you for your efforts to direct us into the proper care of this pavement, I am Yours very truly,

(Signed) F. E. CRANE, City Engineer.

Toronto, Ont., December 19, 1892.

W. G. Mackendrick, Esq., Toronto, Ont.:

Dear Sir: In reply to yours regarding cleaning the asphalted streets, I would say that I consider the present system of cleaning the street with hand brooms and scrapers infinitely better than when sprinkling was resorted to. There is now much less fine and very objectionable dust in front of my office. The water and dust continually formed a slushy mud which made the roadway very slippery, and as a consequence dangerous to traffic, both for horses and pedestrians. Yours respectfully,

(Signed) W. B. KING.

Toronto, Ont., December 19, 1892.

W. G. Mackendrick, Esq., Agent Warren-Scharf Asphalt Paving Co., Toronto, Ont.:

Dear Sir: In reply to your letter of the 16th, we find the asphalt pavement in front of our place of business on Yonge Street is kept much cleaner since the hand broom and scraper system has been inaugurated. The dust and droppings are now swept up and removed, instead of being made sloppy with water and left, disfiguring the street, until the machine sweeper went its rounds at night. Yours truly,

(Signed) WM. H. SPARROW.